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Geometric explanation of accelerating universe based on existence and essence of space-time concept

By: Jalil Omidian

Email: jalilomidian@yahoo.com

Abstract

It is an important question in cosmology to find how the universe is expanding acceleratory. The key to answer this question is to provide a new exact and philosophical definition for the concept of space-time. And based in this definition, using geometrical logic and primary mathematical tools, the movement concept in general, and the accelerating universe specifically, are described. In view of traditional philosophy, every unique concept has two aspects of existence and essence; space-time is defined as a unique concept, in which space is considered as essence and time is considered as existence. The value of this concept can be positive (ordinary space-time) or negative (mass and energy). This value can be expressed either via the unit of time which is second (T) or via the unit of space which is meter (X). They can change into each other via the constant of c, it means that for every second of time as the existence, we will have c meter of space as the essence.

From a geometrical point of view, the quantity of every point of space-time is determined based on its distance from the initial point of space-time. When initial point is an absolute point (starting point of space time or big bang), the quantity which is obtained is universal and if we consider it as an adjacent point, the quantity which is obtained is regional. Therefore, different points which have different distances from the initial point will have different values.

The difference between the space-time of two points leads to the movement of a point relative to another point, this movement can be either regional or universal. In regional space-time the distance between two points is much less than their distances from the absolute initial point, therefore they are considered as adjacent points. Since these two points are close to each other, they have similar dimensions of space-time and therefore their space time difference is almost zero and they do not move relative to each other. In such a condition, each of the points can be considered as the initial point to measure the quantity of the other point, accordingly if one or both of them have a negative space-time value (which has/have mass and or energy), it will cause a difference in their space-time and it will emerge as a constant or accelerating (gravitational) movement.

In view of universal space-time, the distance between two points is so large that it is comparable with their distance from the absolute initial point. Hence, these two non-adjacent points will have a space-time difference. It will result in a receding movement (they get far from each other). When they are more far from each other, they will have larger difference in space-time and consequently they will get far from each other with higher speeds.

Keywords: accelerating universe, space-time concept, universal space-time, receding movement, positive and negative space-time

Introduction

In the history of science there are many examples in which some phenomena are not consistent with the basic cosmological knowledge of human beings. Thus scientists proposed some theories to clarify such phenomena and based on those theories they proposed the presence of some unknown factors, and later on they tried to explore those unknown factors. However, when such basic cognitive determinants became identified or fulfilled, those early phenomena are easily and explicitly explained, without any theorization on unknown factors.

Accelerating universe is one of these phenomena. Since a long time ago, the astronomical observations have shown that the light of distant galaxies is shifting toward red light (3). The farther those galaxies from our plant, the more are the shift toward red light (4, 5). This phenomenon has led to the idea that the universe is acceleratory expanding (1, 2).

However, based on our current knowledge about the universe, it does not seem simple to explain such a phenomenon. Hence, some theoretical models have been proposed to explain this phenomenon. Dark Energy is one of the most important and accepted proposed models (21). This energy is not directly visible, and it includes 68.3% of the total mass energy of the universe. It is considered as a cosmological constant and through a negative force [pressure] leads to acceleratory expanding of the universe (4, 5, 6). Some other models have been proposed to complete the dark energy model or to introduce a completely independent theory; phantom energy is one of them which suggest that the speed of universe expansion might not have any limit.

In this article neither I want to challenge the proposed theories and nor to provide some ideas and comments on the presence of dark energy.

In view of the author, the phenomenon of accelerating universe is about those phenomena which require a precise and complete definition of basic cosmological concepts. These foundations include the basic concepts of physics i.e. space-time, mass, and energy. When such concepts are correctly and rationally defined, then the presence of accelerating universe seems to be completely rational palpable. In fact, it might be said that after the concept of space-time, the concept of acceleratory receding movement of universe elements is the most fundamental and comprehendible concept of physics. Therefore, it is necessary to explain and define clearly and logically the more fundamental concepts of space-time, mass, energy, and using geometrical logic and primary mathematical tools, the movement concept in general, and the accelerating universe specifically, are described.

There are two main views among philosophers, which are contrary to each other, about what space-time exactly is and what is its essence.

The first view (Leibniz and others) says that it is not a dependent and real entity, but rather it is an abstract concept which is used to express the relations between material objects (7, 8). In other words, this concept is like a tool or container which is used to understand and measure physical phenomena; hence without the presence of material objects, space-time would be meaningless. When we talk about the wavelength of light or its frequency, in fact space (length) and time (frequency) are used as concepts for describing a physical feature. Otherwise, without a type of material (light) space-time is meaningless. In author's opinion, in fact, the common concept of space-time in physics is consistent with this view. In this article, wherever I show space-time using small letters (x & t), they indicate the concept of space-time as expressed by this view.

The Second view (Newton and others), which is the basis of this article, on the contrary believes that space-time is not only a real entity but also it is the most basic and fundamental one (7, 8). Hence, space-time is not considered as a container and measuring tool but rather as the content and it has a real existence. In this article, whenever capital letters are used for space-time (X and T) it indicates that we are talking about this viewpoint. Therefore, if we consider space time as a container based on the first view, or as content based on the second view, then their relative value will be similar to the relation between content and container in which a relative decrease in one of them is equal to a relative increase in another one. Therefore, the relative values of these two are reverse. Hence, based on the second view when the relative value of space-time decreases, it is equal to an increase in the space-time as defined by the first view (and vice versa). This is an important factor which should be considered all across the article.

Space-time definition

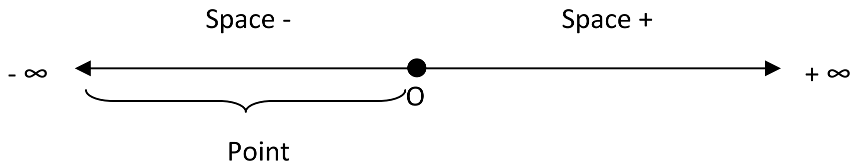
It has been generally accepted by most scientists that space-time is a unique concept and reality (7, 8, 9). In my philosophical point of view which is obtained from the traditional philosophy, the concept of any real object has two aspects: the aspect of essence (nature) which suggests the whatness and identity of an object, and the aspect of existence (reality) which denotes its subsistence1. Therefore for every unique object to exist, it is necessary to have both aspects (22, 23). The main hypothesis of this article is that what we know as the space and time dimensions, are in fact the physical counterparts of these two philosophical aspects. Space is considered as the essence of space-time and time is considered as its existence. In physics and geometrical discussions the equivalent terms for these two aspects are space and time dimensions.

Space as the essence (nature)

Geometrical space, which has three dimensions (or even more), is the representative of the quality or the essence of space-time. However, in this article (to ease the descriptions) we consider it to be one dimensional, i.e. as a line. To describe this line more exactly, it is better to provide a geometrical definition for the line. Based on this description, line (or space) is the distance between two points. It means that whenever it would be possible to discriminate two points, it become possible to show the geometrical distance between them; this distance between two points is described as space. To complete this definition, we need to define point as well. From a geometrical point of view, point is a space without any dimension or is a space whose space dimension has a quantity of zero (10, 11). However, this article provides a more comprehensive definition for a point. Point, by its essence, is a dimensionless space, i.e.

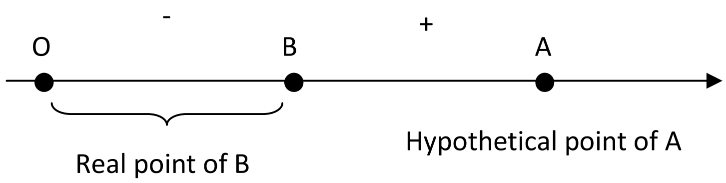
[1] The traditional philosophy, which says "everything" has two aspects of essence and existence, is not much used in the modern philosophy. However, in a logical discussion, which is beyond the scope of this article, it can be shown that these two aspects are useful for describing the most basic concepts. Space-time is also one of the basic concepts (in this article it is considered to be the most basic concept). Based on this definition, and bearing in mind the fact that this view is not favored by most modern philosophers, I decided to use this view for describing the concept of space-time.

it denotes a place, or an object in which there is no space or in which the presence of space becomes rejected. In other words, if space is a "demonstrable" concept, point is a "negative" concept. From a mathematical point of view, a demonstrable concept is a positive quantity and the negative concept is a negative quantity. Accordingly, geometrical space has a positive quantity and geometrical point, which is also called space point, has a negative quantity. Following this definition, several points are not equivalent any more. As space can take different quantities, from zero to infinite, the points also can have different quantities, from zero to infinite. This quantity is measured using meter.



Hence, we can consider a "hypothetical point" as the common definition of point as a quantity of zero, which shows a particular range of a positive (or negative) space, without having a quantity by itself. Nevertheless, "real point" has a negative quantity.

In view of such a definition, if we consider A as a hypothetical point which demonstrates a particular range of space, and consider B as a real point with a negative quantity, then we have:



If we want to use the definition to measure the (positive) space dimensions between two points of A and B, we have to consider one of them as the initial point and another one as the destination. The distance between these two points is considered as the space quantity of the destination point. If we consider the initial point as a real point which has a quantity, its quantity is also added to the previous one and it results in "real quantity" which is shown as X; for example, if we consider B as the initial point, X_A is equal to:

$$X_A \ = AB + (-BO)$$

Where X_A is the real quaintly of point A, which shows the position of point A relative to point B.

However, if we consider A as the initial point, then X_B is equal to:

$$X_B \ = BA + 0 = BA = AB$$

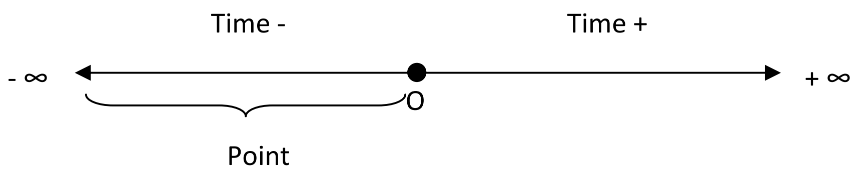
Where X_B is the real quaintly of point B, which shows the position of point B relative to point A.

As a result, we observe that $X_A \neq X_B$. From a geometrical point of view, space dimension, indeed, shows the relative position of a point in relation to another point. Hence, based on what has been stated above, the most important result achieved from the definition of a “real point” is that two points with a space distance, when one or both of them are real points do not have an equal position (distance) relative to each other. Inequality between the quantities of two adjacent space points is an important factor which leads to regional motion, which is later discussed. The author believes that the description proposed for real point and negative space completes the description of space.

Time as the existence (reality):

Everything that exists inevitably has a dimension of time. It is not possible to have an entity without time. On the other hand, it is not possible for an entity to have time but do not exist or it is not possible for something (an entity) to exist (past, present, future) but does not have time. Therefore, it can be concluded that “being existent” requires having time (12). Therefore, the geometrical space described above, if is determined to exist in reality, requires a dimension of time.

Contrary to the space which has several dimensions, time seems that to have only one dimension. It means that like the space introduced in this article, it is a line; however, like space dimension, it has a quantity. In addition, the quantity of time is measured the same, i.e. a time distance [interval] is defined between two time points, and it is measured per the unit of second. Moreover, exactly like a “space point,” a “time point” demonstrates the negative concept of time, which is “timelessness”. As a result, a time point denotes a negative quantity of time.



Likewise, a time point with the quantity of zero can be hypothetically used to determine a time range. However a real time point has a negative quantity. Similarly, when from two time points, one, or both of them are real, do not have an equal time position relative to each other. Accordingly, the time distance between two time points of A and B, when the initial point is a real point, represents a real quantity. If A is hypothetical and B is real, then:

$$TA=AB + (-BO)$$

TA is the real quantity of point A when B is the initial point

$$TB=BA + 0 = AB$$

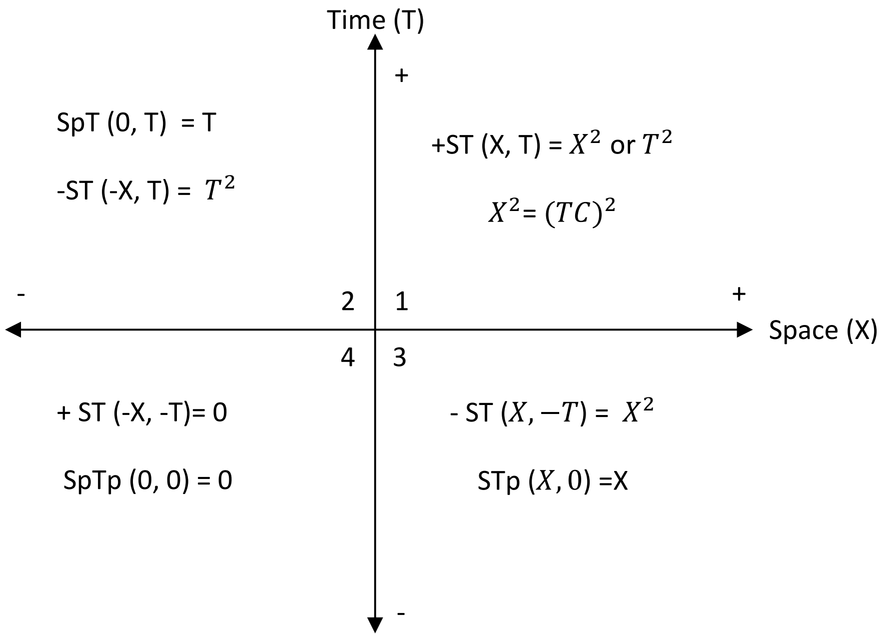
TB is the real quantity of point B when A is the initial point

It is observed that TA≠TB. This inequality leads to regional movement which will be later discussed.

Quantitative relation between space and time: after defining time as the existence and space as the essence of a concept called space-time, we can define a quantitative relation between these two dimensions (aspects). Every second of time as the existence is equal to c meter of space as the essence. This is an inherent relation which does not change unless the units of space (meter) and time (second) change.

$$\frac{essence\ quantity}{existence\ quantity} = \frac{X\ (meter)}{T\ (second)} = c$$

Although time and space were separately defined and described, it is again noted that these two cannot have independent concept at all, rather there is only one unique concept. This concept is generated via the confluence of two axes of time and space which both of them have negative and positive quantities. Consequently, four types of space-time can be categorized which are shown below as four quadrant.



1. In the first quadrant both time and space are positive and thus it is called positive two-dimensional space-time (2DST). Since it is a unique concept, it should be presented via a unique unit i.e. it should be only stated via the unit of time (T) or the unit of space (X). However since it is a two-dimensional identity hence both dimensions are stated either via the unit of space i.e. X.X=X2, or via the unit of time i.e. T.T=T2. We must bear in mind that

X2=(Tc)2. In this article I prefer to use T2 for stating the quantity of two-dimensional space-time (2DST), unless we are talking about the concept of movement.

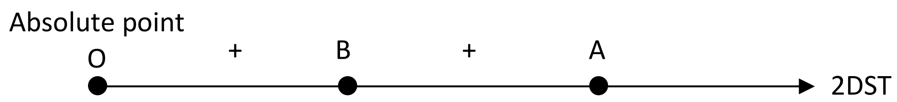
2. The second quadrant includes the negative dimension of space and the positive dimension of time. Hence, this two-dimensional space-time (2DST) is negative and is shown as –ST. In other word, this quadrant shows the positive one-dimensional space-time (1DST) (time) or it can be named one-dimensional point (space point). As a result, it is shown as SpT. Thus, what is known as a real space point, indeed, only has a positive time dimension. This quadrant, accordingly, just has a time dimension and does not have a space dimension. Since this quadrant is a time quadrant, I prefer to use -T2 in its two-dimensional from or T in its one-dimensional form to express its quantity.

3. In the third quadrant, time dimension is negative and space dimension is positive, and consequently 2DST is negative and it is also shown as –ST. meanwhile, in this quadrant is a positive one-dimensional space-time (1DST) (space). It can be named as one dimensional point (time point) and it is, hence, shown as STp. Thus, what is known as a real time point, indeed, only has space dimension and it does not have time dimension since this is a space quadrant I prefer to use -X2 in its two-dimensional form or X in its one-dimensional form to express its quantity.

Consequently, the second or third quadrant can be defined as a one-dimensional identity which does not have one of the dimensions. However, as shown in a two-dimensional figure, it is a negative two-dimensional identity. It means that we can interpret it both as negative 2DST and/or space (or) time point or positive 1DST. It is worth mentioning that what was introduced as negative space-time is only applicable in two-dimensional space-time i.e. when one dimension is negative and another one is positive:

(-T.T=-T2 or -X.X=-X2)

4. In the fourth quadrant both time and space dimensions are negative i.e. neither space dimension, nor time dimension are present. This quadrant is an "absolute point." In other words, both time dimension and space dimension are points, hence I named it a positive two-dimensional point and are shown as SpTp. Hence, in this quadrant X2=0 and T2=0. This point can be assumed as the starting point of space-time. In fact the absolute initial point is a real point and therefore it is used to determine the real space-time quantity of every point in quadrant 1. Every point in this quadrant, in view of its distance from the absolute initial point, has a real space-time quantity which is different from the other points. If we consider A and B as two points in this quadrant, then:



$X_A^2 = AO = AB + BO$ which shows the real quantity of point A

$X_B^2 = BO$ which shows the real quantity of point B

The above quantities can be also shown using T^2.

It can be observed that $X_A^2 \neq X_B^2$. This inequality between the space-time quantities of two points results in the concept of universal movement, which will be discussed.

Quantitative dimensions of space-time and the concept of movement:

As it was stated, from a geometrical point of view, the position of a point in space-time is equal to its distance from initial (zero) point. This distance, indeed, demonstrates the quantitative space-time dimensions of that point, which can be shown via unit of space as meter or unit of time as second. Accordingly, such a space-time can be considered as T or -T2 (quadrant 2) or X or -X2 (quadrant 3) and T2 or X2 (quadrant 1). However, such a quantity is meaningful only when it is compared with the quantity of another point. The other point is the quantity of the reference or observer's point. As the observer always compares the space-time dimensions of different points in relation to its own space-time dimensions, that observer uses such a comparison to measure the space-time position of different points. Without an observer [reference] quantity, all of the other point quantities are meaningless.

It is worth mentioning that because of some other reasons which are beyond our discussion, an intelligent observer always perceives space-time as two distinct dimensions and measures their quantity and does not have any direct perception about negative space-time. Hence the observer perceives only time dimension from the second quadrant, only space from the third quadrant, and both dimensions separately from the first quadrant. In either way, the observer only perceives and evaluates the positive dimension of space-time. Accordingly, if we consider two points of A and B, where A is observer and B is the observed point. The quantity of A in a two-dimensional space-time (2DST) is equal to TA2 and in a one-dimensional space-time (1DST) is equal to TA; likewise, the quantity of B in a two-dimensional space-time (2DST) is equal to T2B and in a one-dimensional space-time (1DST) is equal to TB. Thus, what the observer can interpret in terms of B quantity of space and time separately, in a one-dimensional space-time (1DST) is equal to $\frac{T_B}{T_A}$ and in a two-dimensional space-time (2DST) is $\sqrt{\frac{T_B^2}{T_A^2}}$. Therefore, the observer concludes when the proportions are larger than one then B has a large value and if the proportions are less than one then it has a small value. In other words, the observer always perceives the observed value as a relative value.

But what is clearly tangible for the observer is the difference between positive two-dimensional space-time (quadrant 1) of the two points of A and B which is shown as ΔT_{AB}^2. Since in this quadrant there are both positive dimensions of space and time hence the observer perceives both dimensions and therefore it is likely for the observer to perceive the quantitative relation between space and time (X/T=c) relatively but tangibly, thus:

$$\Delta T_{AB}^2 = \mathrm{T}_\mathrm{A}^2 - T_B^2$$

Again, the observer perceives the value of ΔT_{AB}^2via making a comparison with its own space-time, i.e. as a relative value which is equal to $\frac{\Delta T_{AB}^2}{\mathrm{T}_\mathrm{A}^2}$. Hence, when such a difference is measured in relation to observer quantity, the difference in space-time is relative.

$$\frac{\Delta T_{AB}^2}{T_A^2} = \frac{T_A^2 - T_B^2}{T_A^2} = 1 - \frac{T_B^2}{T_A^2} \qquad \text{(Equation 1)}$$

The above equation shows the relative time difference in two-dimensional space-time (2DST) between the two points of A and B which denotes a difference in 2DST in unit of time per every unit of 2DST of point A with the unit of time.

For every unit of space-time we can use the equation $X^2 = (Tc)^2$ to show the difference in space-time through the unit of space:

$$\frac{\Delta T_{AB}^2 \times c^2}{T_A^2} = \frac{\Delta X_{AB}^2}{T_A^2} = c^2\left(1 - \frac{T_B^2}{T_A^2}\right) \qquad \text{(Equation 2)}$$

The above equation shows the relative space difference in two-dimensional space-time (2DST) between the two points of A and B which denotes a difference in 2DST in unit of space per every unit of 2DST of point A with the unit of time.

Since the observer comprehends space and time separately, it is necessary to express the above equation in a one-dimensional form; therefore to calculate the difference in relative one-dimensional space-time it is necessary to calculate the square root of the above equation ($\sqrt{\frac{\Delta X^2{}_{AB}}{T^2{}_A}}$):

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{1 - \frac{T_B^2}{T_A^2}} \qquad \text{(Equation 3)}$$

The above equation shows the relative space difference in one-dimensional space-time (1DST) between the two points of A and B which denotes a difference in 1DST in unit of space per every unit of 1DST of point A with the unit of time.

From a philosophical point of view, equation 3 represents the difference in the essence quantity of two points of A and B relative to the existence quantity of point A, however from a physical point of view this is the concept which we consider it as the motion of point B relative to point A. it means that, point A which is the observer point is stable and point B is moving relative to point A. If we want to describe the concept of motion with a more non-mathematical language, we may say that point A as an observer for every second of time has c meter of space, while point B, which has different quantity from A, for the same amount of time percieved by the observer has less or more than c meter of space. Such a difference results in a change in the space distance of B relative to A. If such a relative difference is positive, it means that B is getting away from A, and if it is negative it means that it is getting closer to A. Figure (1) shows the mechanism of moving B relative to A which assumes that the value of B is less than the value of A.

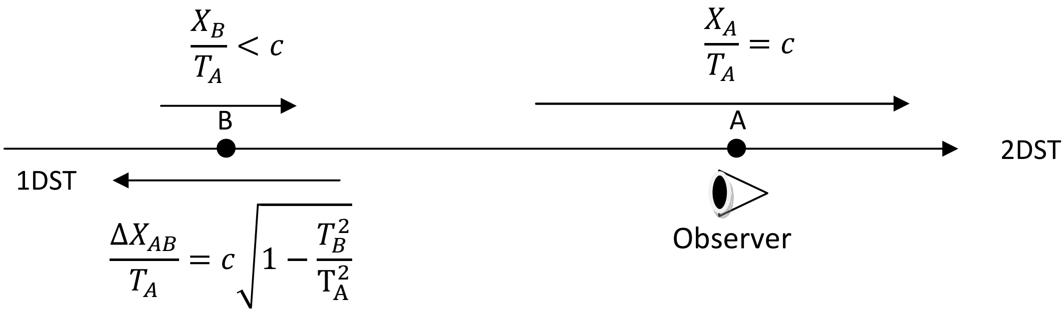


***Figure (1):** point A has c meter of space per every second, point B has less than c meter of space per the same amount of observer's time; consequently point B gets far from point A.*

It is possible that instead of A, B would be the observer point, hence the result of the above-mentioned equations will be, respectively:

$$\frac{\Delta T_{AB}^2}{{T_B}^2} = \frac{T_A^2}{\mathrm{T_B^2}} - 1 \qquad \text{(Equation 4)}$$

Which shows the relative time difference in 2DST.

$$\frac{\Delta X_{AB}^2}{{T_B}^2} = c^2\left(\frac{T_A^2}{\mathrm{T_B^2}} - 1\right) \qquad \text{(Equation 5)}$$

Which shows the relative space difference in 2DST.

$$\frac{\Delta X_{AB}}{T_B} = c\sqrt{\frac{T_A^2}{\mathrm{T_B^2}} - 1} \qquad \text{(Equation 6)}$$

Which shows the relative space difference in 1DST, that shows the movement of point A relative point B.

In fact, the concept of motion is basically equal to the unity of space and time which is based on the rationale of existence and essence. According to this rationale, since every second of time as the existence is equal to c meter of space as the essence, therefore every point in positive two-dimensional space-time has an inherent motion. When two points have equal quantity of space-time, this motion would not be felt and comprehended. However when one of the two points has a quantitative difference relative to the other point, then such a difference will be represented as the movement. For example, when a river is flowing, and all its points are similarly moving, they are indeed stable relative to each other. However, if the flow in one part would become less than the flow in another part, then its (backward) movement would become apparent relative to the other points.

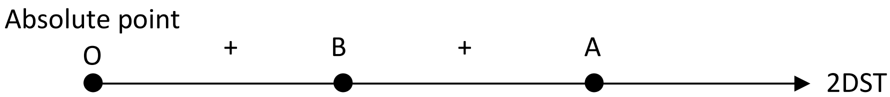
This is an interpretation of the movement which the author tries to present and to show that movement is a secondary concept of space-time which is formed due to quantitative dimensional differences of two points relative to each other. It is completely contrary to the common (special relativity) theories in which the differences of space-time are attributed to the movements.

What has been told was a general definition of movement. However the essence of the movement can be different in view of different dimensions of space-time. The quantity of space-time may be universal or regional.

Quantitative dimensions of universal space-time and concept of universal movement

When the quantitative dimensions of two points of A and B are determined by their distance from an initial absolute point (starting point of space-time) (i.e. fourth quadrant), their quantitative dimensions will be universal.

Whether two points of A and B are hypothetical or real, in such a condition their space-time dimensions are positive two-dimensional (first quadrant).



$T_A^2 = AO = AB + BO$ $\qquad\qquad$ $T_B^2 = BO$

Therefore the space-time quantity of point B is less than that of point A.

However observer quantity of the point is where the observer is located. We assume that such a point is A, then

$$\frac{T_B^2}{T_A^2} = \frac{BO}{AO}$$

From the perspective of observer A, the above equation with a one dimension is equal to:

$$\frac{T_B}{T_A} = \sqrt{\frac{BO}{AO}}$$

Which denotes a reduction in the quantity of space-time of point B relative to point A.

Based on the facts mentioned above, the difference in 2DST is equal to:

$$\Delta T_{AB}^2 = \mathrm{T}_{\mathrm{A}}^2 - T_B^2$$

In universal space time, generally, the distance between two points is representative of the space-time difference of these two points, hence:

$$\Delta T_{AB}^2 = \mathrm{AB}$$

Based on the above mentioned point and Eq. (1):

$$\frac{\Delta T_{AB}^2}{T_A^2} = 1 - \frac{T_B^2}{\mathrm{T}_\mathrm{A}^2} = 1 - \frac{BO}{AO} = 1 - \frac{AO - AB}{AO} = \frac{AB}{AO}$$

It shows the relative time difference in two-dimensional space time of two points of A and B.

Based on Eq. (2):

$$\frac{\Delta X_{AB}^2}{T_A^2} = c^2\left(1 - \frac{T_A^2}{\mathrm{T}_\mathrm{B}^2}\right) = c^2\left(\frac{AB}{AO}\right)$$

Which shows the relative space difference in two-dimensional space-time (2DST) between A and B.

Finally, based on Eq. (3):

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{\frac{AB}{AO}}$$

Which shows the relative space difference in 1DST between two points of A and B, which is in fact the receding movement of B from A.

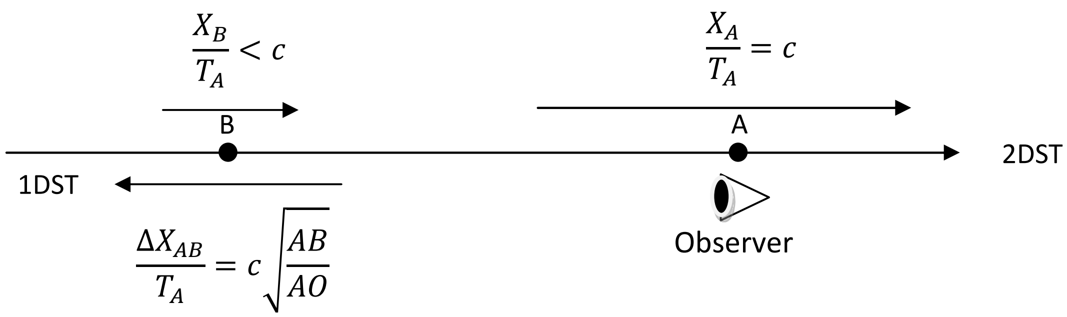


Figure (2): *point A has c meter of space per every second, point B has less than c meter of space per the same amount of observer's time; consequently point B gets far from point A.*

The more A is away from B, the more is the speed; however the upper limit of the speed is equal to c, because when A and B are at the maximum distance from each other then we have AB = AO.

However, if the observer quantity, i.e. the point where the observer is located would be considered as B, then:

Based on equation 4:

$$\frac{\Delta T_{AB}^2}{T_B^2} = \frac{T_A^2}{\mathrm{T}_\mathrm{B}^2} - 1 = \frac{AO}{BO} - 1 = \frac{AB}{BO}$$

Based on equation 5:

$$\frac{\Delta X_{AB}^2}{T_B^2} = c^2(\frac{AB}{BO})$$

Based on equation 6:

$$\frac{\Delta X_{AB}}{T_B} = c\sqrt{(\frac{AB}{BO})}$$

Again, the movement would be receding, however this time A is getting away from B, because B is the observer point, hence it is stable and A will move away. Once again, when the distance between A and B is more, the speed is more. However, this time the upper limit of speed is not equal to c because it is possible for AB to be greater than BO and consequently the speed of A getting away from B would become more than c.

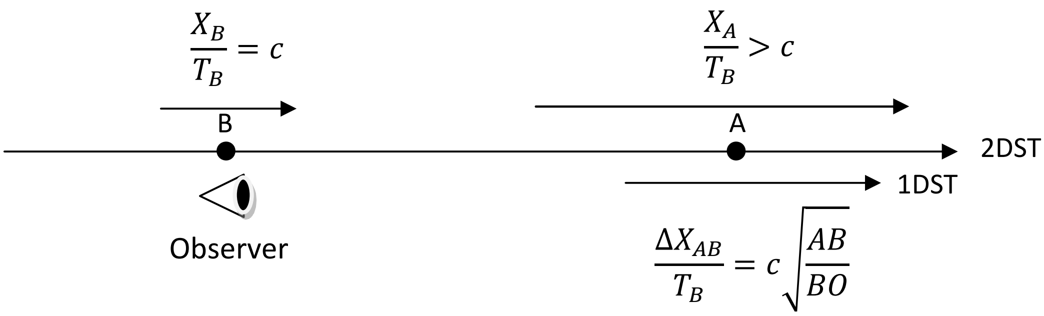


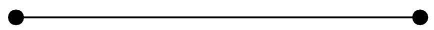
Figure (3): *point B has c meter of space per every second, point A has more than c meter of space per the same amount of observer's time; since point A has larger space-time quaintly; consequently point A gets far from point B.*

Quantitative dimension of regional space-time and the concept of regional movement

According to what has been mentioned above, the universal dimensions of two adjacent points which are located in very large distances from the initial absolute point are approximately equal. When the distance between two points of A and B relative to each other is very small compared with their distance from the initial point, their universal space-time quantity is almost the same and close to each other, therefore it can be said that it is almost equal and consequently their space-time difference is almost zero (AO≈BO). Hence the two points do not have a universal movement relative to each other.

To make it more clearer, when the distance between A to B (AB), relative to the distance between A to initial point (AO), is too low then $\frac{AB}{AO}$ is very small and is almost zero, accordingly $\frac{\Delta X_{AB}}{T_A} \approx 0$. Hence, the two adjacent points do not have a universal movement relative to each other, which means that the two points do not have a space-time difference.

Here we can measure the space-time quantity dimensions of two points and to do so, we have to select each of them as the zero or the initial point for another point. Accordingly, the distance between these two points is considered as space-time quantity of each point relative to the other point:



$T_B^2 = \text{BA}$ $\qquad\qquad$ $T_A^2 = \text{AB}$

B $\qquad\qquad$ A

Every space-time quantity which is achieved in this way is called regional space time.

Accordingly, considering two-dimensional space-time we will have:

$$T_A^2 = \text{AB} \qquad T_B^2 = \text{BA}$$

Since we previously said that their universal dimensions are approximately equal then:

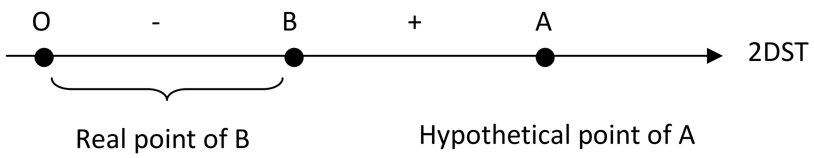
$$T_A^2 = T_B^2 \qquad \text{AB} = \text{BA}$$

However the abovementioned equality is only true regionally when both A and B points would be hypothetical (their dimensions would be zero). When one or both of the two points is/are real, since real points have a quantity, they can be added or subtracted every other point. We assume that A is hypothetical and B is real, hence point B can be considered as a two-dimensional negative space-time and would be used as initial point to measure the positive two-dimensional space-time. Additionally, it can be used as a one-dimensional time point (third quadrant) to measure one-dimensional space-time (time) (second quadrant) between two points of A and B.

A critical point about observer space-time is that in universal space-time two points of A and B are in fact two regions in far reaching spaces and the observer can be in one of them. Observer's space-time is a place where the observer is located. However, in regional space-time where two points of A and B are close to each other, observer can be either one of them or be independent from both of them. In such a condition, observer can choose one of them as the observer's point. For an intelligent observer, always a space point (quadrant 2) is considered as the point, and time point (quadrant 3) is an unknown and unfamiliar concept and the observer does not take it as a point; consequently, always second quadrant is considered as the observer's space-time. Therefore, third quadrant, which is not a space point, cannot be selected as the observer point. Using the abovementioned details, now we can consider two conditions.

First, we consider a situation in which point B is a real point which has negative two-dimension space-time; it is from the second quadrant i.e. it is a space point. Accordingly, it can be considered as the initial point for the measurement of positive two-dimensional space-time of point A. To make it simple, we consider this point as a hypothetical one; however it can be real point as well. Anyway, we mean the geometrical space-time position of point A relative to point B.

Then, the distance of two points of A and B will be the positive quantity of 2DST of ABand point B would have the negative quantity of 2DST of BO and point A will have zero quantity.



Accordingly, the quantity of A relative to B (when B is considered as the initial point) is equal to:

$$T_A^2 = AB - BO$$

Additionally, the quantity of B relative to A (when A is considered as the initial point) is equal to:

$$T_B^2 = BA + 0 = AB$$

Hence, the space-time of point A is less than that of point B.

Since B is a space point (second quadrant), observer will take it as the observer point, Therefore:

$$\frac{T_A^2}{T_B^2} = \frac{AB - BO}{AB}$$

The above condition is perceived one dimensionally by the observer:

$$\frac{T_A}{T_B} = \sqrt{\frac{AB - BO}{AB}}$$

Accordingly, as a result of negative value of point B the quantity of space and time of A reduces compared with point B.

Additionally, based on the definitions of the difference between positive 2DST, we have:

$$\Delta T_{AB}^2 = \mathrm{T}_\mathrm{A}^2 - T_B^2$$

Since B is the observer quantity, based on Eq. (4) we have:

$$\frac{\Delta T_{AB}^2}{T_B^2} = \frac{T_A^2}{\mathrm{T}_\mathrm{B}^2} - 1 = \frac{AB - BO}{AB} - 1 = \frac{-BO}{AB}$$

The above equation shows the relative time difference in two-dimensional space-time (2DST) between two points of A and B.

And based on Eq. (5) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_B^2} = c^2\left(-\frac{BO}{AB}\right)$$

As it was stated the observer perceives the abovementioned relative value as $\sqrt{\frac{\Delta X_{AB}^2}{T_B^2}}$, however, it can be observed that the right side of the equation is negative, therefore to find relative space difference of one-dimensional space-time it is not possible to obtain root square. A solution to this problem can be found in the following explanation: it is expected to see the relative space difference in 1DST as the movement of point A toward point B, because the sign of the right side is negative. In other word a change in ΔX_{AB}in a time interval of T_B is equal to a movement or a reduction in the distance between point A and point B. Therefore, for every quantity of T_B^2 the variable in the left side of the equation is equal to ΔX_{AB}^2 and the variable in the right side of equation is equal to AB. Now we can derivate both sides of the above equation; accordingly, the nominator of the left side of the equation is on the power of one, which shows the difference in one-dimensional space-time.

As a result, the space difference of two points of A and B denominated by the square root of time is:

$$\frac{\Delta X_{AB}}{T_B^2} = -c^2 \times \frac{BO}{2(AB)^2}$$

We find point B, and since B is the observer, it shows that A moves relative to this point. Such a movement is firstly an accelerating movement because the time of B is squared, secondly, it moves toward B, because it is negative and no speed limit can be considered for it because it is likely that BO would be greater than $2(AB)^2$. The below figure shows the mechanism of the movement:

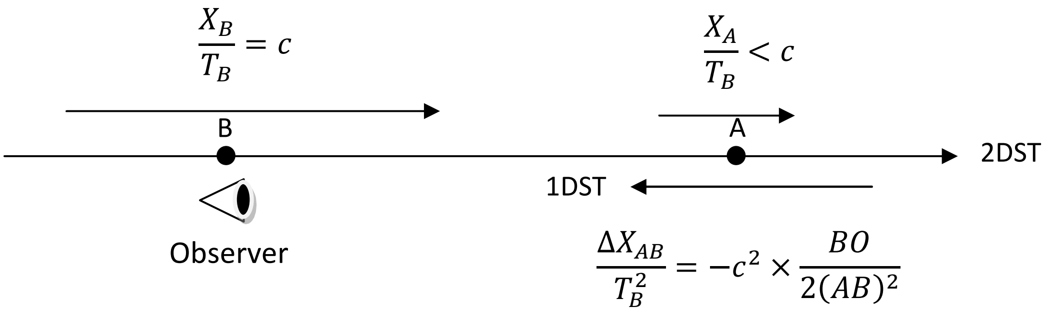
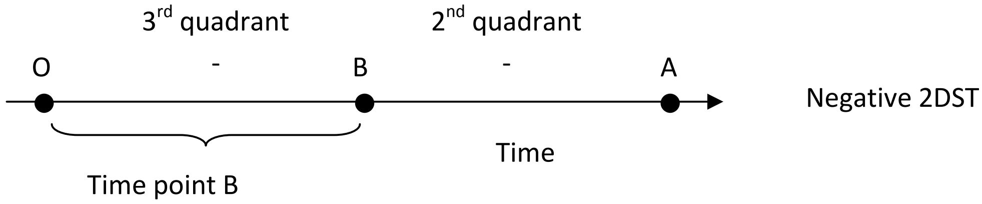
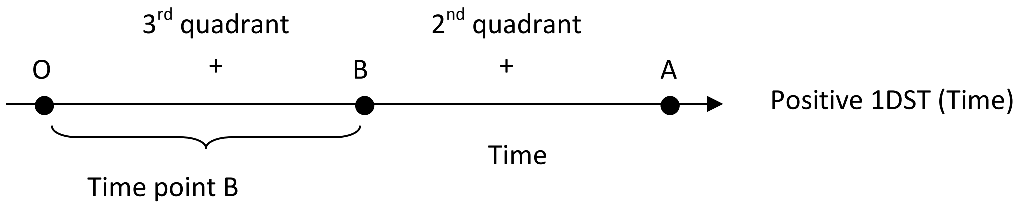


Figure (4): *point B has c meter of space per every second, point A has less than c meter of space per the same amount of observer's time; consequently point A goes toward point B.*

Such a movement is called a regional acceleratory or gravitational movement.

In the second state, point A is still hypothetical and point B is real, however the distance between A and B is not positive 2DST, but rather is negative 2DST. Such a distance is definitely from the second quadrant i.e. it is a space point or 1DST (time), therefore it has only time dimension. The real point B is from the third quadrant i.e. it is 1DST or is a time point (the reverse state can be also considered in which the distance of AB is from the third quadrant and real point B is from the second quadrant. In both states the result is the same. In fact, in such conditions A and B are both real points and each of them can be used as the initial point for measuring the time or space quantity of the other point). As a result, both distances of AB and BO can be considered as negative two dimensional or positive one dimensional. In either case,AB and BO have the same sign.





However, it should be taken into account that the third quadrant is space quantity and to change it into a time quantity it is necessary to be divided by c^2. Accordingly, because the quantity is one-dimensional, the space-time will be calculated using T, thus:

The quantity of point A when considering B as the initial point:

$$T_A = AB + \frac{BO}{c^2}$$

The quantity of point B when considering A as the initial point:

$$T_B = BA + 0 = BA = AB$$

It is observed that the space-time quantity of point A is more than that of point B.

As previously stated quadrant 3 cannot be taken as the observer point, consequently since it is a (hypothetical) space point the observer will take A as the observer (reference) quantity. Then:

$$\frac{T_B}{T_A} = \frac{AB}{AB + \frac{BO}{c^2}}$$

Since the above equation has one dimension it is same as what is perceived by the observer. Accordingly, one dimensional quantity of B relative to A will decrease. The obtained quantities are one-dimensional, therefore, to achieve positive two-dimensional space-time they have to be squared.

$$\mathrm{T}_\mathrm{A}^2 = \left(AB + \frac{BO}{c^2}\right)^2$$

$$\mathrm{T}_\mathrm{B}^2 = (AB)^2$$

The space-time difference between two points of A and B is equal to $\Delta\mathrm{T}_\mathrm{AB}^2 = \mathrm{T}_\mathrm{B}^2 - \mathrm{T}_\mathrm{B}^2$.

Based on Eq. (1) the relative time difference in 2DST between two points of A and B is:

$$\frac{\Delta T_{AB}^2}{T_A^2} = 1 - \frac{T_B^2}{\mathrm{T}_\mathrm{A}^2} = 1 - \left(\frac{ABc^2}{ABc^2 + BO}\right)^2$$

And based on Eq. (2) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_A^2} = c^2(1 - \left(\frac{ABc^2}{ABc^2 + BO}\right)^2)$$

And finally based on Eq. (3) the relative space difference in 1DST between two points of A and B is:

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{1 - \left(\frac{ABc^2}{ABc^2 + BO}\right)^2}$$

Since point A is observer, it shows the movement of B relative to this point. This is a constant movement (since T_A is a root square). Additionally, it is a receding movement, because the sign of the right side is positive. The figure below shows the mechanism of this movement:

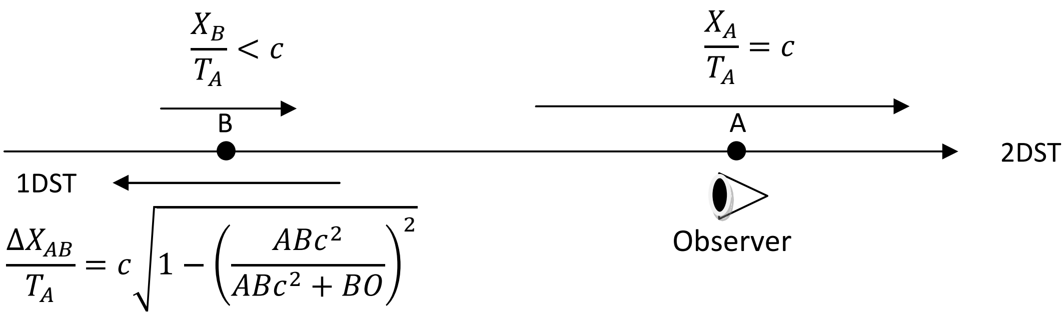


Figure (5): *point A has c meter of space per every second, point B has less than c meter of space per the same amount of observer's time; consequently point B gets far from point A.*

This is called "constant regional movement" which as clear from the above equation, its upper limit is equal to c.

Consequently, two basic movements were identified: the first one is the universal receding movement which happens when the absolute zero point (two-dimensional point) is considered as the initial point for measuring space-time dimensions of each of two points; the second one is a regional movement which happens when each of the two adjacent points is considered as the initial point for measuring space-time dimensions of the other point. The later movement also has two forms of acceleratory approaching and constant receding movements.

What has been presented so far are some completely geometrical analyses which are based on presented definitions of space-time. The question which may arise is whether there are physical observable counterparts for the results of such analyses; the answer is yes.

Physical space-time

In view of the author different quantities of space-time which have been presented in four quadrants, based on the presented definitions of space-time, have physical counterparts. The mentioned geometrical analyses also can justify them. As a result, we expect the mentioned types of movements would be also observable in physical phenomena as well. Therefore, the physical counterparts of the four mentioned quadrants are as follows.

The first quadrant: the physical counterpart of this quadrant is the space and time which we are already familiar with. Space is the distance between two objects (like the distance between earth and moon) and time is an interval between two events (like the time interval between two geologic eras). Its basic difference is that the physical counterparts of space and time are considered separately, while it has been said that space-time is a unique reality. Therefore, what we know as the physical space is measured per meter and (in this article) we demonstrate it as R (regional space-time) and U and d (universal space-time); in fact, it represents the space-time obtained from the first quadrant (T^2). However, since its quantity varies from zero to R, to fully represent T^2 in 2DST we have to consider its average i.e. $\frac{R}{2}$. If T^2 would be considered as the quantity of space-time in the first quadrant with the unit of time, then $T^2 = \frac{R}{2}$ and therefore if X^2 is considered as quaintly of space-time in the first quadrant with the unit of space, then $X^2 = \frac{Rc^2}{2}$.

This is also true about the physical time as well. We show physical time with t, half of which can be considered as the representative of the first quadrant. However in this article since space per meter and as the essence is more familiar, we use it as the representative of the first quadrant.

The second quadrant: it is the negative two dimensional space-time or one-dimensional point (space) or one-dimensional space-time (time). The best choice to be selected as the physical counterpart of this quadrant is "mass." A mass (without any volume) is indeed a real space point, i.e. it does not have space dimension. However, it has a time dimension. In other words, it "exists" (i.e. it has time dimension) but it does not have an essence (does not have a space dimension). As a result, in this article, it is assumed that mass is the physical counterpart of the second quadrant, however, the second quadrant has a time quantity with the unit of second, while the unit of mass is kilogram. Accordingly, the constant coefficient of Q changes it to unit of time i.e. second, Then:

$$T = MQ$$

Therefore:

$$X = MQc^2$$

we will see that

$$G = Qc^2$$

where G is the gravitational constant.

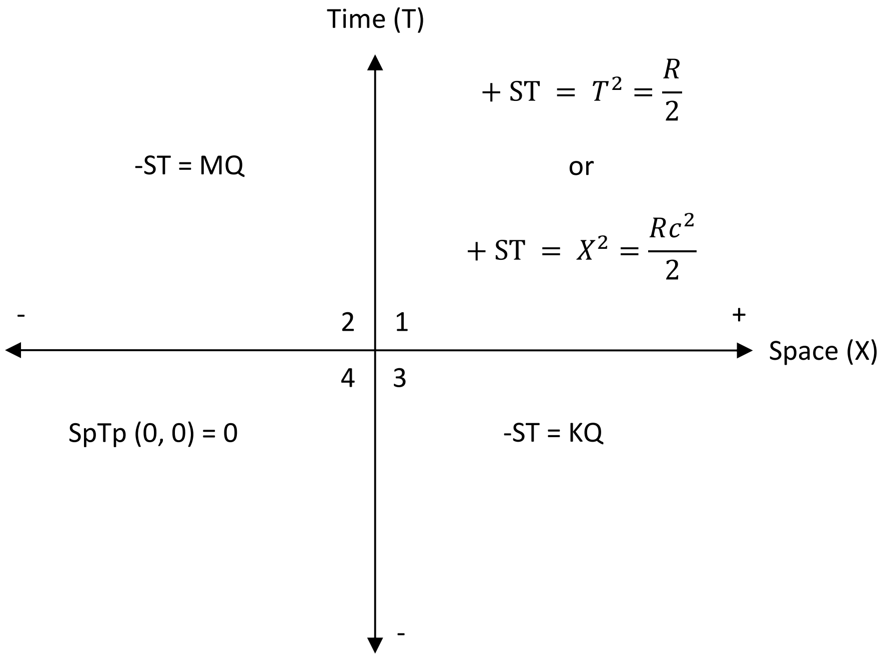
The third quadrant: it is the negative two-dimensional space-time, or one-dimensional time point, or just one-dimensional space-time (space). If we take mass as the physical counterpart of the second quadrant, from the relation between second and third quadrants we can conclude that the best candidate for the third quadrant is kinetic energy. Such a relationship between mass and energy is well known (13, 14).

Kinetic energy without any mass is indeed a time point, while it has a space dimension but does not have a time dimension. The third quadrant has a space quantity. Nevertheless, the unit of joule is used for the quantity of energy. Once more, we use the constant coefficient of Q to change it to the unit of space i.e. meter, hence:

$$X=KQ$$

$$T = \frac{KQ}{c^2}$$

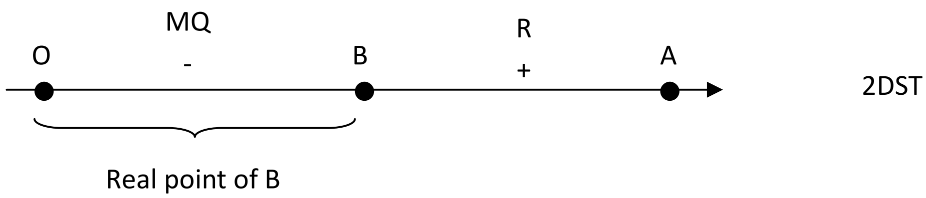
Accordingly, using the new physical symbols, the four mentioned quadrants will be as follows.



Now, again we analyze the universal and regional space-time quantities using their physical counterparts.

Regional physical movement

First we consider two points of A and B which encompass a positive two-dimensional space-time. Point A is hypothetical and point B is a real space point, hence its space time is two-dimensional. If we consider that point B is from the second quadrant, it will have a negative quantity of BO, and point A will be located at a positive distance (quadrant 1) of AB from point B. The physical presentation of such a condition is a mass of M kilogram (point B) which in a distance of R from that point (AB) there is a hypothetical point (point A). This hypothetical point can be either a mass or any other thing.



$$AB = \frac{R}{2}$$

$$BO = MQ$$

The quantity of point A when considering B as the initial point:

$$T_A^2 = AB - BO = \frac{R}{2} - MQ$$

The quantity of point B when considering A as the initial point:

$$T_B^2 = BA = AB = \frac{R}{2}$$

The space-time quantity of point A is less than that of point B.

Since point B is a real point from the second quadrant which is a space point therefore it is considered as the observer quantity. Hence, the time ratio is equal to:

$$\frac{T_A^2}{T_B^2} = \frac{AB - BO}{AB} = \frac{R - 2MQ}{R}$$

This ratio, from the perspective of observer B in a one-dimensional form is equal to:

$$\frac{T_A}{T_B} = \sqrt{\frac{AB - BO}{AB}} = \sqrt{\frac{R - 2MQ}{R}}$$

Considering that $Q = \frac{G}{c^2}$ then:

$$\frac{T_A}{T_B} = \sqrt{1 - \frac{2MG}{Rc^2}}$$

The above equation show that in a close distance from a heavy mass, the quantity of space-time reduces (based on the second view or the view of this article). Of course, based in the first view this quantity increases. For instance, a physical event with a time interval of Δt when occurs at a distance of R from a mass, based on the following equation, will have a time interval of Δt_A:

$$\frac{\Delta t_A}{\Delta t} = \sqrt{\frac{Rc^2}{Rc^2 - 2MG}}$$

This is the time ratio when close to a heavy mass, which has been predicted from general relativity (9, 15, 16).

The above equation, in terms of quantity, is completely the reverse form of the equation proposed by this article.

The space-time difference between two points of A and B is equal to $\Delta \mathrm{T}_{\mathrm{AB}}^2 = \mathrm{T}_{\mathrm{A}}^2 - \mathrm{T}_{\mathrm{B}}^2$.

Since T_B is the observer quantity based on Eq. (4) the relative time difference in 2DST between two points of A and B is:

$$\frac{\Delta T_{AB}^2}{T_B^2} = \frac{T_A^2}{\mathrm{T}_{\mathrm{B}}^2} - 1 = \frac{R - 2MQ}{R} - 1 = \frac{-2MQ}{R}$$

And based on Eq. (5) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_B^2} = c^2\left(-\frac{2MQ}{R}\right)$$

And finally based on Eq. (6) to obtain the relative space difference in 1DST between two points of A and B it is necessary to calculate the root square; since the right side is negative, it is not possible to calculate root square, however based on what previously was mentioned we derivate both sides of the above equation; it will result in:

$$\frac{\Delta X_{AB}}{T_B^2} = c^2\left(-\frac{MQ}{R^2}\right)$$

Since $Q = \frac{G}{c^2}$ Then:

$$\frac{\Delta X_{AB}}{T_B^2} = \left(-\frac{MG}{R^2}\right)$$

From this equation it can be concluded that every point like A (either hypothetical or real) with an acceleration of $\frac{MG}{R^2}$ relative to point B moves. Since this movement has a negative sign, the movement will be toward point B. This movement has not any speed limitation because it is possible for R^2 to become less than MG.

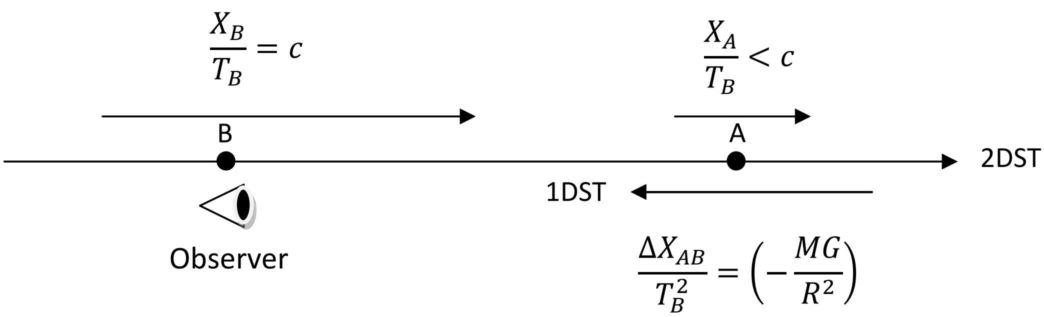
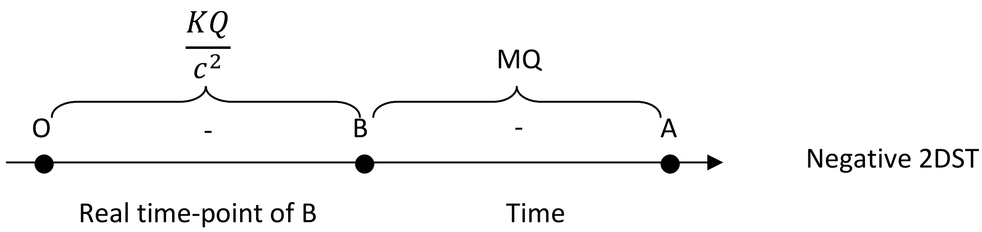
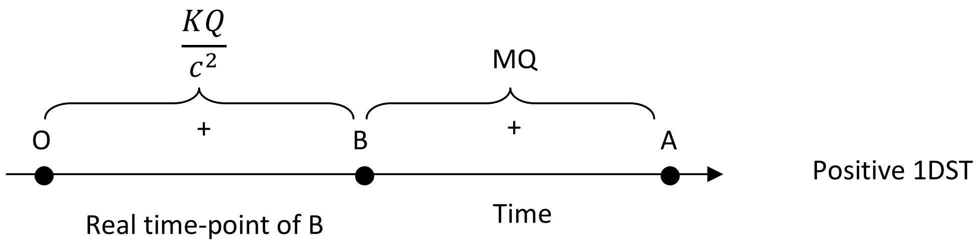


Figure (6): *point B (Mass) has c meter of space per every second, point A (whatever is located in point A) has less than c meter of space per the same amount of observer's time; consequently point A goes toward point B.*

As a result, the space distance of every point which is at a distance of R from a mass, with a passage of time of B will reduce. This is the concept which we know as gravity. It means that gravity is a concept of movement which is caused because of the differences in the positive 2DST of two adjacent points, which one or both of them are real space point. Contrary to the general relativity which believes that the differences in space-time are due to gravity (9, 15, 16), this article says that the gravity itself is the result of the difference in the space-time of two points.

Now, we consider the second state of regional space-time quantities with a physical representation, where the distance between two points of A and B is a one-dimensional space-time. We clearly consider a situation in which the distance is only a time interval (i.e. it is from the second quadrant) and B is a real point as the initial point from the third quadrant which is a time point. It means that the distance between A to B, is a one-dimensional space time (time) and point B is a one-dimensional time point. The physical representation of such a condition is a mass of M kilogram (AB) which has K Joule of kinetic energy (BO). In fact, both AB (mass) and energy (BO) are one dimensional; the first one is one-dimensional time and the second one is one-dimensional space.





Overall, since space-time is one-dimensional, so:

The quantity of point A when considering B as the initial point:

$$T_A = AB + BO = MQ + \frac{KQ}{c^2}$$

The quantity of point B when considering A as the initial point:

$$T_B = BA + 0 = BA = AB = MQ$$

The space-time quantity of point A is more than that of point B.

Since point B is from the third quadrant which is time point (not a space point) it cannot be considered as the observer quantity; thus point A is selected as the observer point because it is space point although it is hypothetical. Therefore relative space-time is equal to:

$$\frac{T_B}{T_A} = \frac{Mc^2}{Mc^2 + K}$$

Since the above ratio is one dimensional, observer A perceives the same ratio. The space-time difference between two points of A and B is equal to $\Delta T_{AB}^2 = T_A^2 - T_B^2$.

However, as said before, TA and TB are one-dimensional, thus to calculate the difference of positive two-dimensional space-time they will be squared:

$$T_A^2 = (MQ + \frac{KQ}{c^2})^2$$

$$T_B^2 = (MQ)^2$$

Therefore, considering T_A^2 as the observer quantity based on Eq. (1) the relative time difference in 2DST between two points of A and B is:

$$\frac{\Delta T_{AB}^2}{T_A^2} = 1 - \frac{T_B^2}{\mathrm{T}_\mathrm{A}^2} = 1 - \left(\frac{Mc^2}{Mc^2 + K}\right)^2$$

And based on Eq. (2) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_A^2} = c^2(1 - \left(\frac{Mc^2}{Mc^2 + K}\right)^2)$$

Finally, based on Eq. (3) the relative space difference in 1DST between two points of A and B is:

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{1 - \left(\frac{Mc^2}{Mc^2 + K}\right)^2} = V$$

This is the phenomenon which we know as the constant movement of mass of M kilogram with a kinetic energy of K joule. from a geometrical point of view, two points of A and B which are two quantities with the same space location, because of differences in time quantity they will obtain a space difference as well. Point A is the place where the observer is located or is a hypothetical space point which is considered by the observer for the mass, and point B is where mass is really located. Point A or the observer has a higher quantity of space-time (time). Point B (the mass with the energy) has lower quantity of space-time. The difference between these two quantities is presented via the movement of B relative to A and since its sign is positive, it has a receding movement. As observed its quantity cannot be larger than the speed of light.

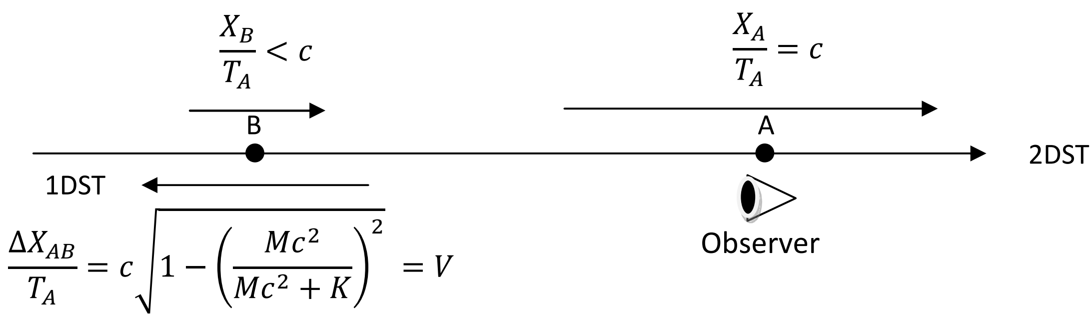


Figure (7): *point A (observer or the point where observer considers for mass) has c meter of space per every second, point B (mass with energy) has less than c meter of space per the same amount of observer's time; consequently point B goes away from point A.*

If we show this speed with V, using the above equation, we have:

$$\frac{T_B}{T_A} = \frac{Mc^2}{Mc^2 + K} = \sqrt{1 - \frac{V^2}{c^2}}$$

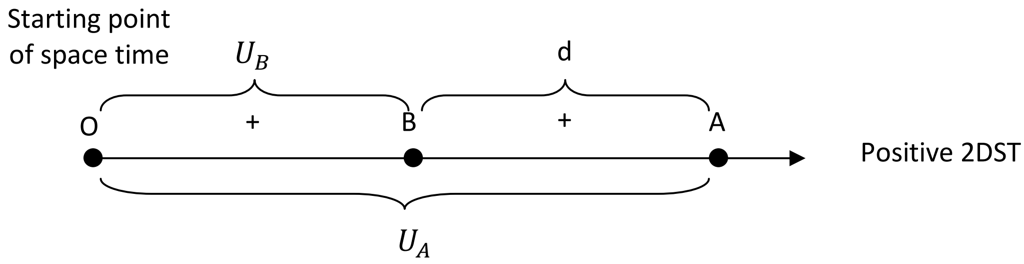
This is a relative time quantity of point B which observer A perceives. However, as it was stated since in the common physics the concept of space-time is based on the first view, which is contrary to the view of this article, the above ratio is reversed. For example, when $\Delta t_A$is the interval of a time event in point A (stable observer) and Δt_B is the interval of the same event in point B (moving mass) then the below relation will be established between them:

$$\frac{\Delta t_A}{\Delta t_B} = \frac{T_B}{T_A} = \frac{Mc^2}{Mc^2 + K} = \sqrt{1 - \frac{V^2}{c^2}}$$

This equation is the same with relativity of time which is expressed in special relativity theory (16, 17). Hence, once again, contrary to the relativity theory (in which the moving agent causes a relative time difference between the observer and the moving object), here the time differences cause a movement of object relative to observer.

Universal physical movement:

In this condition, both points of A and B are located in positive two-dimensional space-time quantity and their space-time quantity is measured based on their distance from the absolute initial point i.e. the fourth quadrant. It means that we consider a condition in which A and B are so far from each other that their distance from each other is comparable to their distance from the absolute initial point. Based on the extant theories this point must be the starting point of space-time or big bang (18, 19, 20) and the distance between two points of A and B based on cosmic distances is more than the dimensions of intergalactic distances.



The physical counterpart of space-time can also be based on space or time. Generally, the cosmic dimensions of light-year are considered.

The distance from A to initial point which is shown with U_A is considered as universal quantity of 2DST of A:

$$AO = U_A$$

The distance from B to initial point which is shown with U_B is considered as universal quantity of 2DST of B:

$$BO = U_B$$

The distance between A and B is shown as d,

AB=d

then:

$$T_A^2 = AO = U_A$$

$$T_B^2 = BO = U_B$$

$$AO = AB + BO$$

$$U_A = d + U_B$$

Accordingly, the space-time quantity of point A is more than that of point B.

However as it was mentioned $\frac{U}{2}$ and $\frac{d}{2}$ must be used as the physical representative of space-time but since it is true for all the three forms of U_A , U_B , and d, we can ignore it. Now we consider the first assumption of universal space-time in which the observer is located in point A; when it observes any other point like B, the other point is closer to big bang (we assume that the observer is located in galaxy A and is observing galaxy B), then:

$$\frac{T_B^2}{T_A^2} = \frac{U_B}{U_A} = \frac{U_A - d}{U_A}$$

The above ratio is perceived in a one dimensional form by the observer as below ratio:

$$\frac{T_B}{T_A} = \sqrt{\frac{U_A - d}{U_A}}$$

Accordingly, when $\Delta t_A$is the interval of a time event in point A and Δt_B is the interval of the same event in point B then the below relation will be established between them:

$$\Delta t_B = \frac{\Delta t_A}{\sqrt{\frac{U_A - d}{U_A}}}$$

The difference of positive two-dimensional space-time of two points of A and B is:

$$\Delta T_{AB}^2 = \mathrm{T}_\mathrm{A}^2 - T_B^2$$

The difference between the distance of the two points of A and B is equal to their space-time difference, i.e.:

$$\Delta T_{AB}^2 = d$$

Accordingly and based on Eq. (1) the relative time difference in 2DST between two points of A and B is:

$$\frac{\Delta T_{AB}^2}{T_A^2} = 1 - \frac{T_B^2}{\mathrm{T}_\mathrm{A}^2} = 1 - \frac{U_A - d}{U_A} = \frac{d}{U_A}$$

And based on Eq. (2) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_A^2} = c^2 \frac{d}{U_A}$$

And finally based on Eq. (3) the relative space difference in 1DST between two points of A and B is:

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{\frac{d}{U_A}} \qquad \text{(Equation 7)}$$

This means that from the view of the observer, point B is moving away with a speed of Eq. 7.

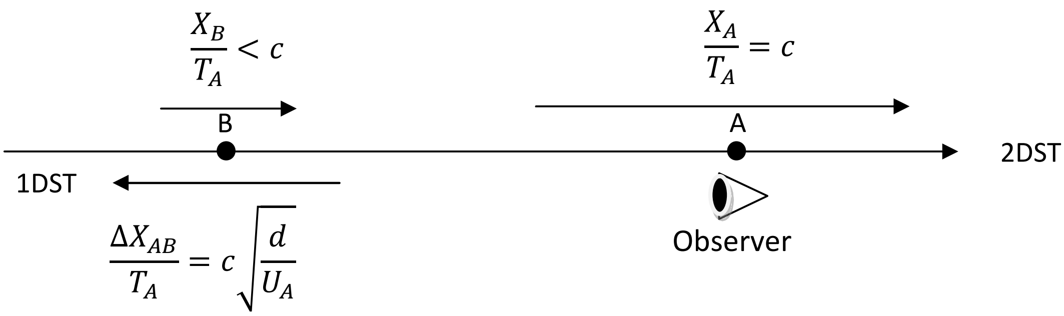


Figure (8): *Galaxy A has c meter of space per every second, galaxy B has less than c meter of space per the same amount of observer's time; consequently galaxy B gets far from galaxy A.*

Observer would observe that the point B or the galaxy B is moving away with a speed of $c\sqrt{\frac{d}{U_A}}$ and as their distance (d) increases the speed will be more. The upper limit of the speed is the light speed, because the largest distance between A and B is o, i.e. when d=U_A. Accordingly, we have:

$$\frac{\Delta X_{AB}}{T_A} = c$$

However, if we consider the second assumption, in which observer is in point B and is observing point A, and compared with point B, point A is further away from the initial point, then:

$$\frac{T_A^2}{T_B^2} = \frac{U_A}{U_B} = \frac{U_B + d}{U_B}$$

The above ratio is perceived in a one dimensional form by the observer as below ratio:

$$\frac{T_A}{T_B} = \sqrt{\frac{U_B + d}{U_B}}$$

Based on Eq. (4) the relative time difference in 2DST between two points of A and B is:

$$\frac{\Delta T_{AB}^2}{T_B^2} = \frac{T_A^2}{\mathrm{T}_\mathrm{B}^2} - 1 = \frac{U_B + d}{U_B} - 1 = \frac{d}{U_B}$$

And based on Eq. (5) the relative space difference in 2DST between two points of A and B is:

$$\frac{\Delta X_{AB}^2}{T_B^2} = c^2 \frac{d}{U_B}$$

And finally based on Eq. (6) the relative space difference in 1DST between two points of A and B is:

$$\frac{\Delta X_{AB}}{T_B} = c\sqrt{\frac{d}{U_B}} \qquad \text{(Equation 8)}$$

Again the observer sees that the point or the galaxy of A is moving away with a speed of $c\sqrt{\frac{d}{U_B}}$ However this time the upper limit of moving away is not equal to the light speed and indeed there is no limit for increasing speed of moving away, because it is possible for d to become more than U_B. Consequently, the speed of moving away will exceed the speed of light.

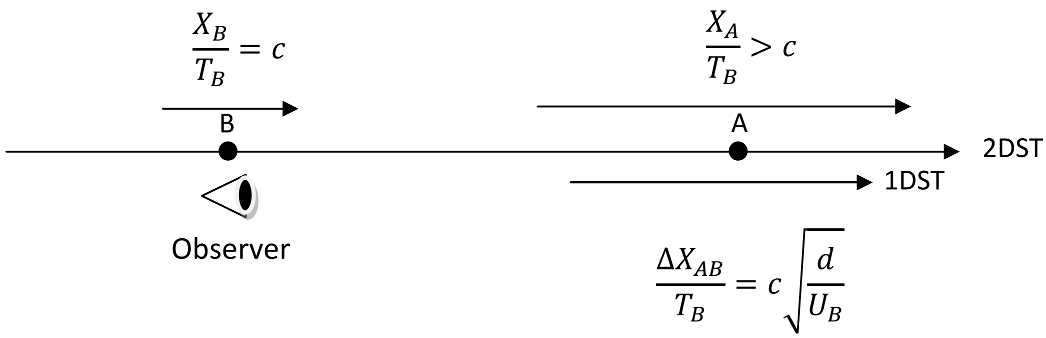


Figure (9): *Galaxy B has c meter of space per every second, galaxy A has more than c meter of space per the same amount of observer's time (because it has higher space-time quantity); consequently galaxy A gets far from galaxy B.*

Because of the presence of mass and energy (negative space-time) in galaxies, they can have positional regional approaching movement (gravitational) toward each other. However in a universal scale, the quantity of this movement is small compared with the universal receding movement. Nevertheless, it is likely they would be able to neutralize some amounts of the receding movement. As a result, it can be expected that the speed of receding in practice would be less than the speed calculated based on equations 7 and 8.

Universal movement in three dimensional space

What has been mentioned so far was based on one dimensionality of geometrical space. According to this view, the vacant one dimensional space (line) was considered as the representative of two dimensional space-time. Such a line has an absolute initial point, and the distance from every point on the line to the initial point with the unit of meter is considered as the quantitative two dimensional space-time of that point. Additionally, the distance between every two points on the line, from each other is representative of the two dimensional space-time difference of those points. The proportion of the space-time difference of these two points with the unit of space to the space-time of each of these two points with the unit of time is called the relative space difference, which indicates the receding movement of the two points relative to each other.

The above mentioned assumptions are also true for three dimensional space, however, instead of a line, a sphere is representative of physical two dimensional space-time (in the theory of relativity, this type is called four dimensional space-time, however, in this article to put emphasis on the concepts of existence and essence of space-time, I will call it two dimensional space-time. Space dimension, as the essence, has three "directional dimensions"; these three dimensions are not inherently different from each other, and they are just representative of space direction. Therefore, all the three dimensions can be considered as one dimension. However, time as the existence is inherently different from space, hence, it is considered as a separate dimension. As a result, only two dimensions are considered for space-time).

The absolute initial point is at the center of the sphere and the distance between every point on the sphere and its center is representative of the two dimensional space-time value of that point. In addition, the distance between every two points on the sphere from each other is representative of space-time difference of those two points. Also, the relative space difference leads to receding movement of these two points from each other. In fact, in this case, in addition to space difference of the two points from the initial point (which leads to space-time difference), their different directions from the center also leads to the receding movement of the two points from each other; for example if two points of A and B have similar distances from the initial point (have similar space-time quantity), each point has c meter of space per every second of time, however since they have two different directions, they get far from each other (Figure 9).

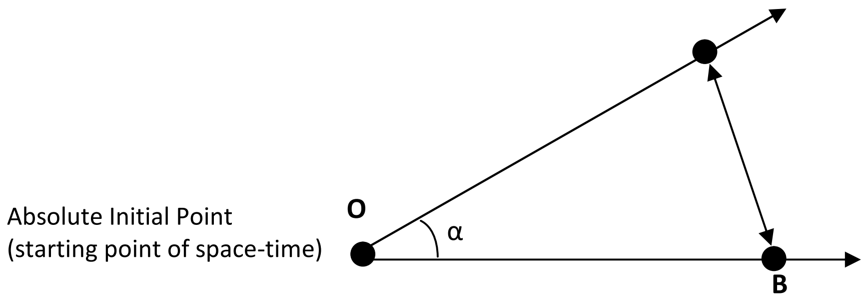


Figure (9)

To involve this factor, we consider the geometrical equation to determine the space-time difference between the two points.

Based on the aforementioned description, we consider two points of A and B in the sphere (galaxy A and galaxy B) which are at two different distances and two different directions from the center (starting point of space-time or big bang), so that central α angle is placed between them (Figure 10).

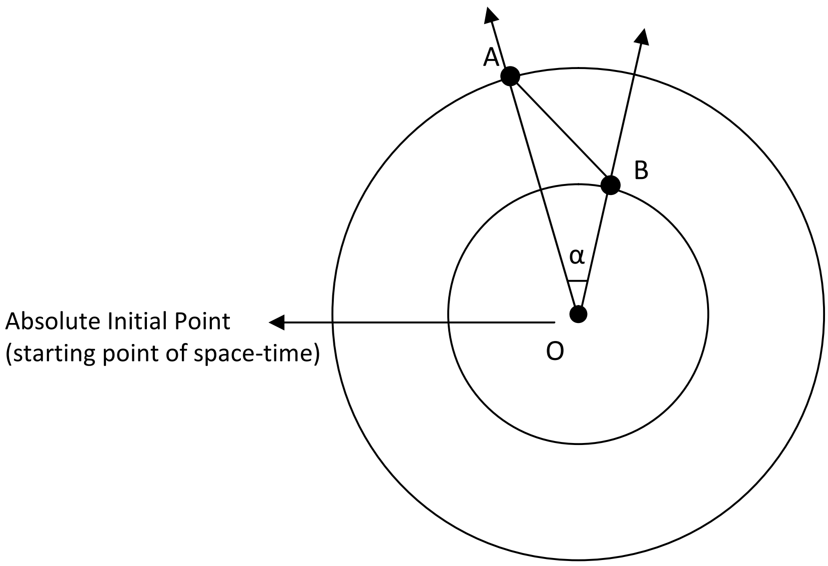


Figure (10): three dimensional space, which has been depicted two dimensional to make it easier to show

The distance from A to O is the space-time quantity of point A:

$$T_A^2 = AO = \text{UA}$$

The distance from B to O is the space-time quantity of point B:

$$T_B^2 = BO = UB$$

The relative space time is:

$$\frac{T_A}{T_B} = \frac{t_B}{t_A} = \frac{U_A}{U_B}$$

The distance from A to B is the space-time difference of the two points of A and B:

$$\Delta T_{AB}^2 = AB = \sqrt{U_A^2 + U_B^2 - 2U_A U_B Cos\alpha}$$

As a result, the relative two dimensional space difference, when the observer is at point A, is equal to:

$$\frac{\Delta X_{AB}^2}{T_A^2} = \frac{c^2\sqrt{U_A^2 + U_B^2 - 2U_A U_B Cos\alpha}}{U_A}$$

And the relative one dimensional space difference is equal to:

$$\frac{\Delta X_{AB}}{T_A} = c\sqrt{\frac{\sqrt{U_A^2 + U_B^2 - 2U_A U_B Cos\alpha}}{U_A}} \qquad \text{(Equation 9)}$$

Equation (9) indicates the receding movement of point B from point A.

When the observer is in point B, this is equal to:

$$\frac{\Delta X_{AB}}{T_B} = c\sqrt{\frac{\sqrt{U_A^2 + U_B^2 - 2U_A U_B Cos\alpha}}{U_B}} \qquad \text{(Equation 10)}$$

Equation (10) indicates the receding movement of point A from point B.

The above equations indicate the speed of receding movement of two points from each other. Nevertheless, as it was said before, the gravitational effect of mass and energy in the galaxies on the two points should be also considered, which reduces the receding speed compared with the values calculated by equations (9) and (10). It can be concluded from the above equations that as the distance between two points in the universe increases and as the central angel become wider, they will recede from each other with higher speed, which even may exceed the speed of light. If the equations would be true, it can be concluded that most elements in the universe would go away from us with an speed higher than the speed of light so that we will never be able to see them.

Conclusion

Based on the description of space-time which is rooted in rationale of existence and essence, what we know as the movement of two points relative to each other, are in fact the difference in the essence (space) of these two points per the existence (time) of one these two points.

The quantity of space-time for every point is in fact the distance of that point from the absolute initial point. Therefore, when two adjacent points (close to each other) are in a long distance from the absolute initial point, we can say that they have almost the same distance from the absolute initial point and therefore they have almost the same quantity. Therefore their space-time difference is zero and they do not move relative to each other. However, in such a condition the observer takes one of them as the initial point to measures the quantity of space-time for each point. If one or both points would be real i.e. they have negative value (with mass and or energy), then they will have a difference in value. It will result in their regional movement relative to each other.

However, if they would be so far from each other that their distance would be comparable with their distance from absolute the initial point, then they will have different value of space-time and they will have space difference. Such a space difference per time of one of these two points will emerge as a receding movement. This is a universal movement and it describes why far away regions in universe are getting far from each other. When they are more far from each other they will move away from each other with a quicker speed.

Consequently, the essence of universal movement differs from that of regional movement. The presence of mass and energy is required for regional movement; however they are not needed for universal movement. As a result, to justify a phenomenon called accelerating universe, there is no need to explore and discover the concept of dark energy.

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