

HYPOTHESIS BASED ON THE THEORY ON THE MOTION RELATED TO THE EXPANDING SPACE

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ABSTRACT

In "Theory on the Motion Related to the Expanding Space", published on November 2nd, 2018, I affirmed that from it we can derive some hypotheses on the various phenomena of the Universe.

And now, with this paper, I propose to expose these hypotheses, which explain various phenomena of the Universe in a way compatible with said theory and more consistent with the observations compared to that currently supported by the Scientific Community.

Here are, in short, the hypotheses.

The Universe is exclusively composed of an infinity of space quanta, which tend to expand and thus cause the Universe to expand.

Matter manifests on sets of space quanta, which are compressed and thus enabling the neighbouring quanta, and later the quanta further apart, to expand further.

Gravity is due to the phenomenon that each object tends to move towards the more expanded space quanta and, therefore, towards other objects. The expansion of space is seen from General Relativity, as the curvature of the space-time, therefore, since it is the same phenomenon, the same physical laws are applied. I also present a modification to the universal gravity formula, to make it compatible with this model of the Universe.

Speed of light depends on the degree of expansion of space quanta in the locations in which it transits, meaning that the greater the expansion, the lower the speed. But since also clocks move more or less rapidly according to their degree of expansion, speed of light results always the same at any location. Therefore, in the past, when the degree of expansion of space quanta was minor, speed of light was greater.

Cosmological redshift is due to the speed of the location in which the celestial object receiving photons, is moving, compared to the location in which the celestial object emitting it, has moved, in a Universe in decelerating expansion. In support of this hypothesis, I present two tables that simulate the journey of the photons of a high-redshift galaxy and that of Cosmic Microwave Background Radiation. I also present a formula for calculating the apparent brightness, compatible with the observations of type Ia supernovae with high redshift.

Moreover, I demonstrate that considering that the cosmological redshift is due to the expansion of space, as the Scientific Community currently supports, the apparent brightness of celestial objects with high redshift, cannot be justified.

And since the cosmological redshift is considered as a factor of expansion of space, to respect what claim the Special Relativity, said apparent brightness not only doesn't prove that the expansion of the Universe is accelerating, but shows that the Special Relativity is not compatible with the observations and, therefore, is falsified.

Keywords:

Preferred Reference Frame, CMBR, Cosmic Microwave Background Radiation, space quanta, expansion of the universe, General Relativity, speed of light, redshift, photons, type Ia supernovae.

1. INTRODUCTION

In "Theory on the Motion Related to the Expanding Space" (1), I affirmed that from it we can derive some hypotheses on the various phenomena of the Universe.

And now, with this paper, I propose to expose these hypotheses, which explain the expansion of the Universe, gravity, the speed of light, the cosmological redshift and the apparent brightness of the high-redshift celestial objects, in a way compatible with said theory and more consistent with the observations, compared to the explanations currently supported by the Scientific Community (SC).

2. A UNIVERSE OF SPACE QUANTA**2.1 Expansion of the Universe**

The Universe may be imagined as an immense sphere composed exclusively of an infinity of tiny indivisible particles of an equal amount of space, which, from now on, I will call "space quanta".

By "space" I mean a continuous substance, therefore not made up of particles (which means that the very small space quanta are not made up of even smaller particles) that tends to expand. In practice it is the only real substance composing the Universe and, therefore, it must be very different from the matter we are able to observe.

At the time of the so-called Big Bang, the quanta were extremely compressed. Therefore they immediately began to expand, causing the expansion of the Universe, which is still ongoing.

The speed of this expansion is the same in all locations in the Universe, so that each location moves away from any other location at a speed that depend on distance: the more distant they are and the faster they move away from each other.

So every location can be considered as a center of the Universe, from which all the other locations move away.

2.2 Gravity

There is no vacuum among the space quanta. Therefore if one single quantum compresses and shrinks in size, the adjacent quanta can/must increase in size and thus expand.

Matter is made up of space quanta.

The elementary particles of the so-called standard model of quantum physics, are physical phenomena that, amongst other things, compress space quanta. Therefore a material object contains a huge number of sets of compressed space quanta, that increase the average compression of the space quanta composing it.

Consequently the quanta adjacent to the object, i.e. those situated in the front line (first liner), can/must expand further due to the reduction in size of the quanta of the object. However they are later partially recompressed, because the second-liner space quanta, which are now more compressed because they have not undergone any expansion, expand in turn towards the first-liner space quanta. Later also the quanta in the third line, still compressed, expand towards those in the second line, and so on, until the quanta ever more distant from the object.

In other words, matter squeezes large amounts of space quanta and allows the neighbouring quanta, and then gradually those farther away from them, to expand more.

The result is an environment in which the space quanta situated in the vicinity of matter, are more expanded than those located far from it.

The quanta composing matter are more compressed than the external ones. However, for the sake of precision, we should say that the average compression of the quanta composing matter, is greater than the average compression of those outside of it. This is because atoms include numerous quanta that could even be more expanded than those outside of it, i.e. those between the nuclei and the electrons, in that they are located closer to the elementary particles.

The sets of quanta composing the atoms, tend to expand in the direction of the most expanded (or less compressed) quanta, as they encounter less resistance to their expansion. Therefore since material objects are made up of atoms, they expand in the direction of the most expanded quanta and thus in the direction of other objects. For this reason every object tends to move towards other objects.

To move an object in the opposite direction than the one in which it would tend to move, i.e. from a point where the quanta are more expanded (e.g. from ground level) to a point where they are less expanded (e.g. 1 m from the ground), one must use a certain energy (which is lost by those who move the object), with which the compression of the sets of quanta (which thus increase their internal energy) that compose the atoms of the object is gradually increased, in order for them to oppose to the greater pressure of the quanta they encounter as they approach the higher level.

However, more precisely, we should not think of quanta as moving from one point to another, but of quanta compressions as moving from one point to another. Or, better yet, to physical manifestations occurring in different points in space.

Consequently an object of one meter in height, has its atoms situated in a higher position at a higher mean compression rate, compared to the lower atoms, as the quanta making up the higher atoms, encounter more resistance to their expansion, compared to the quanta in the lower atoms. Therefore, assuming that the object has the shape of a cube, it will have a larger lower

surface area than the upper one, because the compression of the quanta situated near the lower surface, is smaller than that of the quanta closer to the upper surface. However, if measured, the two surfaces would still appear to be the same, as the atoms of the measuring instruments themselves, are subject to expansion of the neighbouring quanta.

Now I would like to make some considerations about the formula of the universal gravitation of Newton and propose modifications, because it is not compatible with the present model of the Universe, as it provides two causes for the expansion of the space quanta:

- one is to the presence of matter, for which the space quanta expand without contributing to expand the Universe (because their expansion is balanced by the compression of the space quanta that make up the matter);
- one is the native expansion of the space quanta, for which the space quanta expand and the Universe also expands.

Therefore it is necessary to modify the formula of the universal gravity of Newton, to take it into account.

The current formula of universal gravity is as follows:

$$\mathbf{F} = \mathbf{G} \frac{\mathbf{M} \cdot \mathbf{m}}{\mathbf{d}^2}$$

From which I derive the gravity acceleration for an object of small mass, namely:

$$\mathbf{g} = \mathbf{G} \frac{\mathbf{M}}{\mathbf{d}^2}$$

Where:

- **g** is gravity acceleration;
- **G** is a universal gravitational constant;
- **M** is the mass of a hypothetical celestial object;
- **d** is the distance of the small mass object.

But this formula concerns only the acceleration related to the expansion of the quanta due to the presence of matter, therefore it does not include that relating to the native expansion of the space quanta, which goes in the opposite direction and, therefore, opposes the acceleration due to the gravity.

Therefore, the complete formula of gravity acceleration, according to my Universe model, is as follows:

$$\mathbf{g} = \mathbf{G} \frac{\mathbf{M}}{\mathbf{d}^2} - \mathbf{E} \cdot \mathbf{d}$$

where **E** is a constant of acceleration due to the expansion of space, which is the same throughout the Universe and which decreases over time as a function of the deceleration of the expansion of the Universe, and which is to be valorised according to the observations.

But to settle the calculations we need to increase the value of the gravitational constant, since the value g to be obtained is also due to the value of the acceleration constant.

Therefore we must evaluate the two constants of the formula, so that its results are compatible with the observations, which show that in long distances the value of g is not perfectly inversely proportional to the square of the distance. As in the case of celestial objects more external to galaxies.

Moreover from the formula it results that once a certain distance has been overcome, the value related to the native expansion of the space quanta exceeds the one due to the presence of matter, so the object of small mass moves away from the celestial object, as is clear from the observations.

2.3 Speed and frequency of photons, variables

It was experimentally observed that

(1) Gravity affects the flow of time and photon wave frequency and therefore their wavelength (2).

However, based on this hypothesis,

(2) Gravity is caused by expansion of space.

Consequently, it can be stated that

(3) The expansion of space affects the flow of time (the more space expands, the more clocks slow down) and photon wave frequency and therefore their wavelength.

However, since it also results that

(4) Photon speed remains unvaried regardless of which location it is measure and, therefore, at any time flow speed,

it results that

(5) also photon speed adapts to the expansion of space, and namely photons move either faster or slower depending on the level of expansion of space.

Therefore, in the past,

(6) When the space was much less expanded, photons moved at a much higher speed than the present, although hypothetical clocks of the time would still measure it at 300,000 km/s (as they would measure time faster because the space was less expanded).

In other words, as the space expanded, photon speed dropped, although hypothetical clocks would have slowed down and therefore still measured photon speed at 300,000 km/s.

As shown at point 3, the expansion of space affects photon wave frequency.

More precisely it slows down wave frequency although hypothetical clocks would not be able to detect it, because expansion also slows them down proportionally. If this were not the case, the frequency of the photons emitted by a given type of source (e.g. hydrogen) and measured by the same clock, would be higher on the top of a mountain (where space is less expanded) than at its foot (where space is more expanded).

Therefore, in the past, when space was less expanded, the frequency of the photons emitted by a given type of source (e.g. hydrogen), was much greater than now and later slowed down, as the space became expanded. However, hypothetical clocks would have not been able to detect any deceleration in frequency, as they too would have slowed down proportionally.

Essentially, those photons may themselves be seen as clocks.

2.4 Comparison between expansion of space and curvature of space-time

Summarizing the contents of the previous paragraphs:

- space is a substance in which both matter and electromagnetic waves are manifested, it has an expansion that is influenced by the presence of matter and it is more expanded near the material masses and increasingly less expanded as one moves away from them;
- material objects tend to move where space is more expanded and then toward other material objects;
- the speed of light is isotropic only with respect to space;
- the speed at which time flows, is a function of the expansion of space, that is, the more the space is expanded and more the time slow down;
- because the space is less expanded, as you move away from the surface of the Earth, time flows faster as you move away from the Earth, as seen in observations (for example, in GPS).

In conclusion, the space is Euclidean and has three dimensions and one degree of expansion, and the velocity at which time flows is a function of the degree of expansion in the location where it is measured.

Now I try to explain why, instead, for General Relativity (GR) space-time is curved.

Based on the results of the experiment by Michelson and Morley (MM), from which it turns out that the speed of light is isotropic with respect to any inertial reference frame (but according to Lorentz, this result is vitiated by the slowing down of time and the contraction of the interferometer of MM, as a function of its speedy with respect to space - which for Lorentz corresponds to the ether), Einstein deduced the theory of Special Relativity (SR), whose transformations use the three spatial dimensions plus the temporal dimension, whereby space has "become" space-time.

Subsequently Einstein, with the GR, showed that the speed of time is a function of gravity and, therefore, of the distance squared from the material masses, as also resulted by the observations.

In fact, in paragraph 6.6 of the chapter concerning the GR, of his book "Six Not-So-Easy Pieces" (8), Feynman demonstrates the difference between two clocks located at different altitudes.

Feynman also finds the numerical value of the deviation for 20 meters of difference in height, ie about $2 \cdot 10^{-15}$, ie about $1 \cdot 10^{-16}$ per meter of difference in height.

This is demonstrated by reasoning on an accelerated spacecraft (Fig. 6-17), in which it is understood that if two signals are sent from bow to stern spaced by one second, they are spaced less than one second. So for an observer next to the clock at the stern, the one at the bow goes faster.

After that, he places the spaceship on the earth's surface and uses the Equivalence Principle (EP) to deduce that the effect that was seen in the accelerated spacecraft must also be seen in the Earth's gravitational field.

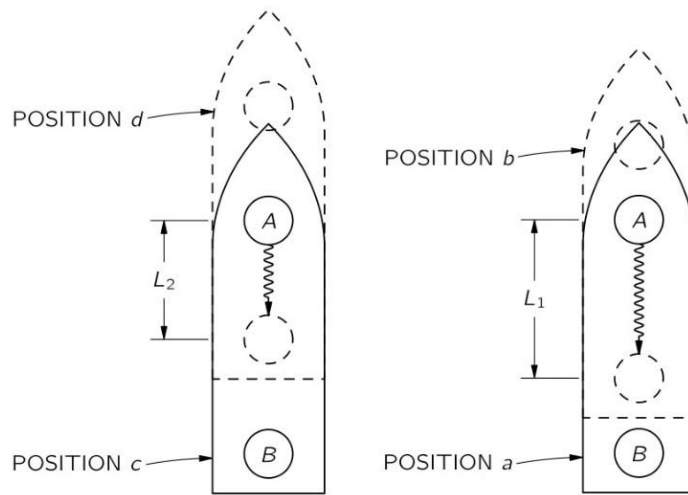


Figure 6-17 A clock at the head of an accelerating rocket ship appears to run faster than a clock at the tail.

Then in paragraph 6.7, based on the reasoning set out in paragraph 6.6, Feynman demonstrates the curvature of space-time by using the drawings shown in Figure 6-18.

SIX NOT-SO-EASY PIECES

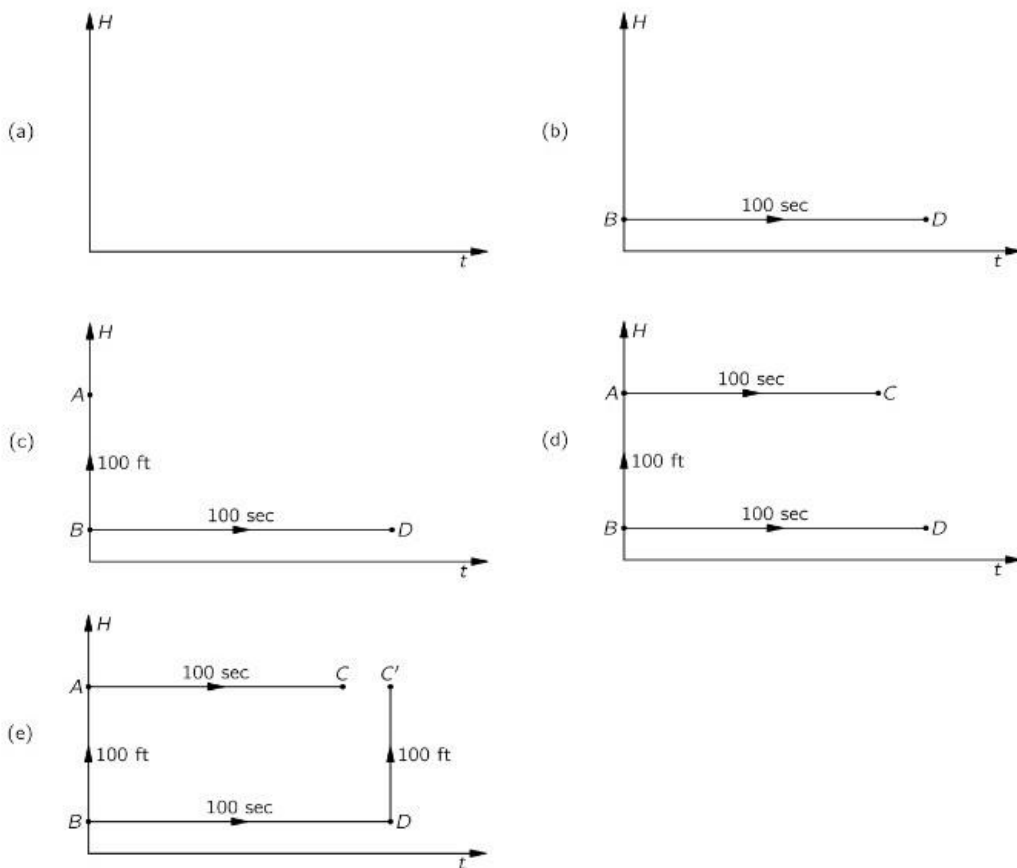


Figure 6-18 Trying to make a rectangle in space-time.

Here's how he shows it.

“Let’s try to do some geometry in space-time. That may at first sound peculiar, but we have often made diagrams of space-time with distance plotted along one axis and time along the other. Suppose we try to make a rectangle in space-time. We begin by plotting a graph of height H versus t as in Figure 6-18(a). To make the base of our rectangle we take an object which is *at rest* at the height H_1 and follow its world line for 100 seconds. We get the line BD in part (b) of the figure which is parallel to the t -axis. Now let’s take another object which is 100 feet above the first one at $t = 0$. It starts at the point A in Figure 6-18(c). Now we follow its world line for 100 seconds as measured by a clock at A . The object goes from A to C , as shown in part (d) of the figure. But notice that since time goes at a different rate at the two heights—we are assuming that there is a gravitational field—the two points C and D are not simultaneous. If we try to complete the square by drawing a line to the point C' which is 100 feet above D at the same time, as in Figure 6-18(e), the pieces don’t fit. And that’s what we mean when we say that space-time is curved.”

In other words, while for the hypotheses presented here, the fact that the segments at heights A and B , have a different length, depends on the phenomenon that the degree of the expansion of space at said heights is different, for the RG said fact shows that the space-time is curved.

In conclusion, according to the present hypothesis, the space is Euclidean and has one degree of expansion, and the speed of time is a function of said degree of expansion.

Instead for the SR space has "become" space-time, which for the GR is curved.

In practice both for the hypotheses presented here and for the GR, it is the same phenomenon, even if seen from different points of view (Ptolemaic for the GR and not Ptolemaic for the hypotheses presented here), therefore everything foreseen by the GR, should also apply to the hypotheses presented here.

3. MODEL OF THE UNIVERSE

The deceleration in photon wave frequency due to space expansion and the subsequent increase in their wavelength, is known by the SC as “cosmological redshift”.

However, in the previous paragraph, I argued that along with said deceleration in frequency, a deceleration of clocks also occurs proportionally and, therefore, no redshift is detected.

In conclusion space expansion does not let measure, at least directly, any deceleration in photon wave frequency and, consequently, not even the cosmological redshift.

Hence, what could cause the high redshift value detected in photons coming from very distant celestial objects?

As I will demonstrate below, it is due to the recession speed of the location where the celestial object receiving the photon is moving, compared to the location where the celestial object emitting it, was moving.

Hence said redshift is still due to the expansion of space, as the expansion stretches the distances between different locations in the Universe, thus increasing the recession speed of locations in it, but only indirectly.

In support of this hypothesis, I am presenting two simulation tables:

- the first one, which simulates the journey of the photons of a high-redshift galaxy, also using the apparent brightness of high-redshift celestial objects;
- the second, which simulates the journey of the Cosmic Microwave Background Radiation (**CMBR**).

3.1 Exemplification of the model of the Universe

In order to better understand the two simulations mentioned above, I will introduce them with a simple exemplification.

Let us imagine the expanding Universe as a large rubber sphere constantly inflating, with numerous points marked on its surface (identifying locations in the space).

Let us imagine a galaxy as a lorry moving on the surface of our sphere at a speed of 0.1 m/s, remaining in the vicinity of a point.

Now let us imagine Earth as another lorry also moving near a point, at a speed of 0.1 m/s.

Because of the expansion of the sphere, the two points above move apart from one another at a certain speed. Consequently the two lorries move away from one another at the same speed (more or less in function of the direction of their motion).

Now let us imagine photons as a set of cars moving on the surface of the sphere at constant speed, e.g. 1 m/s.

We will now observe that, due to the expansion of the sphere's surface, the points move apart from one another, therefore each car will move at a speed of 1 m/s relative to the point over which it passes, but at a different speed compared to the other points marked on the sphere surface.

If a car starts from a point in the sphere (marking the location where the galaxy is moving) to reach another point (marking the location where Earth will move upon its arrival), at the start it will move at a speed of 1 m/s relative to the starting point, however it will move at a lower speed relative to the arriving point, as it is moving apart from it, due to the sphere's surface expansion.

During its journey, its speed relative to the arrival point, will increase due to the constant increase in distance between the point over which it passes (still at 1 m/s) and the starting point. Finally it will arrive at a speed of 1 m/s relative to the arrival point, which will move at a given speed relative to the starting point. Hence the car will move at a speed of more than 1 m/s, of said given speed, relative to the starting point.

3.2 Simulation of the journey of the photons of a high-redshift galaxy

As mentioned above, space expands at the same speed at any location in the Universe. Therefore any location moves away from any other location at a speed that depends on distance.

In other words any location in the Universe may be considered as its centre because any other location moves apart from it and also because photons that move through it have the same speed, i.e. 300,000 km/s, in all directions.

However, if the photons move at a speed of 300,000 km/s relative to the locations they are passing through, and those locations move increasingly faster from their location of emission, even photons move increasingly faster relative to their location of emission.

For example the photons emitted by a galaxy and going towards the Earth, at the emission have a speed of 300,000 km/s relative to the galaxy's location (more precisely, relative to the "location where the galaxy is moving", as no celestial object is at rest relative to its location, but we will just call it "location" for the sake of brevity), but far smaller relative to the Earth's location (more precisely, "the location where Earth will be at upon arrival", but we will just call it "Earth's location" for the sake of brevity), because it is moving apart from the galaxy's location.

But as the photons move towards the Earth's location, through locations that move increasingly faster relative to the galaxy's location, the photons move at an increasingly speed relative to the Earth's location, reaching it at 300,000 km/s with respect to it.

Said speed increase corresponds to the speed of the receiving location relative to the emitting location. It is used as a factor for calculating the so-called cosmological redshift, indicated by the symbol "z", whose value incremented by 1, corresponds to the ratio between the speed of light and the difference between it and the speed of the receiving location relative to the emitting one **(formula 3.2.1)**

$$1 + z = \frac{c}{(c - v_r)}$$

Where " v_r " represent the speed of the receiving location.

This is a formula of the Doppler shift, which considers the receiver in motion and the source motionless. From this formula can be derived also the formula for calculating the speed of the receiving location, i.e. **(formula 3.2.2)**

$$v_r = c - \frac{c}{1 + z}$$

The formula used by the SC, instead, considers the receiver motionless and the source in motion, whereby the factor **z** results from the ratio between the speed of source and that of the light. Consequently in order to calculate the speed of source knowing the factor **z**, this must be multiplied by the speed of light **(formula 3.2.3)**.

$$\text{speed of source} = z \times c$$

But for the SC, the **z** factor refers to space expansion and not to the recession speed between the various locations of space.

For the sake of precision, I would like to point out that besides the cosmological redshift, there are also the ones caused by the motion of the emitting and receiving objects, relative to their respective locations, which in this case are not particularly relevant, but is still comprised in the measured value on the Earth.

For example, a redshift of 0.59 measured on the Earth, indicates that Earth moves apart from the galaxy at a speed of 111,321 km/s.

$$v_r = 300,000 - \frac{300,000}{(1 + 0.59)} = 111,321$$

To better explain how this works, using the Excel application, I have drafted a simulation table of the journey towards Earth of the photons of a high-redshift galaxy, which I am presenting here below.

I drafted this table for the sole purpose of demonstrating the validity of this hypothesis so, even though I have tried to obtain realistic results, I may only present them as an example.

Redshift values are based on a paper by astronomer Vincenzo Zappalà (2).

JOURNEY TO EARTH OF PHOTONS OF A HIGH-REDSHIFT GALAXY

Time	----- speed on start locat. ---		-----	-- distance ----			----- progressive -----				
Progr.	transit	photons	Redshift	Earth	photons	Earth	diff.ce	diff.ce	phtons	Earth	
	locat.	+ locat.	z + 1	locat.	+ locat.	locat.			+ locat.	locat.	
	A	C	D	E	F	H	I	J	K	L	M
Start			1.590	275,000	0.000	5.040	-5.040	-5.040	-	5.040	
1	18,217	318,217	1.450	224,095	1.061	0.747	0.314	-4.726	1.061	5.787	
2	35,201	335,201	1.340	185,427	1.117	0.618	0.499	-4.227	2.178	6.405	
3	51,321	351,321	1.250	156,548	1.171	0.522	0.649	-3.577	3.349	6.926	
4	66,640	366,640	1.175	135,745	1.222	0.452	0.770	-2.808	4.571	7.379	
5	81,591	381,591	1.110	121,795	1.272	0.406	0.866	-1.942	5.843	7.785	
6	96,492	396,492	1.052	113,866	1.322	0.380	0.942	-1.000	7.165	8.164	
7	111,321	411,321	1.000	111,321	1.371	0.371	1.000	0.000	8.536	8.536	

Speed values are expressed in km/s.

Distance values are expressed in billions of light-years.

Time values are expressed in billions of years.

POSTED VALUES:

Speed of Earth at Start	275,000
Initial distance of Earth's location	5.040

How to calculate the values entered in the table (for those who want to try to understand them).

I am explaining below the methods by which I calculated the values shown in the table. This is only a general explanation because the entire method would be too complex to describe here (the Excel table I mentioned is available on request).

I would also like to point out that compared with the Excel worksheet based on which the table was drafted, I had to hide two columns, due to lack of horizontal space.

The first one is marked as column **B** and lists photon speed relative to the locations crossed, i.e. always 300,000 km/s in each cell.

The second one is marked as column **G** and lists the distance travelled by the photons relative to the different locations, i.e. always 1 billion light-years in each cell.

First of all, based on the redshift, for each period I calculated the mean velocity at which the locations progressively passed through by the photons, move away from the galaxy's location, using the formulas in 3.2.2 and then entered it in the "speed -- transit locat."- column (**C**).

Then I added said speed value to that of the photons relative to the locations passed through (300,000 km/s) and I entered the result in the cells of the "speed -- photons + locat." column (**D**).

At this point I calculated the distance travelled by the photons, by dividing the values shown in the "speed -- photons + locat." column (**D**) by 300,000, and I entered the results in the "distance -- photons + locat." column (**H**).

Then I obtained and entered the progressive values in the "distance -- progressive -- photons + locat." column (**L**).

As can be seen, in the last cell of said column, it results the value of 8.536 billion light-years, which corresponds to the sum of the total distance travelled by the photons with the recession distance of the location passed through, sum that corresponds to the current distance between the location of the galaxy and that of Earth.

At this point through a formula for calculating apparent brightness (3.3.1) – see explanation in paragraph 3.3 (to better explain my formula, I needed the table, so I had to postpone the explanation) – I obtained the ratio between the actual distance and that of the time of photon emission, and I calculated its value of 5,040 billion light-years.

Then, using Excel functions, I have varied dichotomically the Earth's speed at Start, until in the last cell of "distance – progressive -- diff.ce" column (**K**) value 0 appears, and thus I obtained the mean speed of outdistance of the Earth's location from that of the galaxy, which I calculated according to the redshifts of the various periods, as displayed in the "speed -- Earth locat." column (**F**).

Finally, for each period, I calculated the recession distance of the Earth's location compared to that of the galaxy, and I entered it into the "distance – Earth locat." column (**I**). I then entered its progressive value in the Excel cells of the "distance -- progressive -- Earth locat." column (**M**).

End of calculation mode.

The table shows that at the start of the journey, the Earth's location is 5,040 billion light-years away from that of the galaxy, a location that due to the expansion of space between itself and that of the galaxy, is moving away at the speed of 275,000 km/s from the galaxy's location, thus making the Earth also moving away from the galaxy.

In the following periods the speed at which the Earth's location move away from that of the galaxy, decreases, and, consequently, the expansion of space decelerates (this phenomenon is also described in paragraph 3.4).

Finally, when photons arrive on Earth, the Earth's location is 8.536 billion light-years, compared to that of the galaxy, and its recession speed relative to that of the galaxy is 111,321 km/s.

During their journey, again due to the expansion of space, photons also vary in speed relative to the galaxy's location, increasing as they travel to locations farther away relative to the galaxy's location and therefore move away at an increasingly higher speed from the galaxy's location.

Finally photons arrive at the Earth's location at a speed of 300,000 km/s relative to it, but at 411,321 km/s relative to the galaxy's location.

3.3 Formula for calculating the apparent brightness of high-redshift celestial objects

Using the data of the table shown in the previous paragraph as an example, I am now presenting a formula I believe is more consistent with the observations than the one sustained by the SC, to obtain space expansion occurred during the journey of the photons of a high-redshift celestial object, using its apparent brightness.

I find this important because, as stated by SC, according to the apparent brightness found in high-redshift type Ia supernovae, Universe expansion manifests in acceleration rather than in deceleration, while my hypothesis proves this wrong, by stating that the Universe expansion manifests in deceleration rather than acceleration.

Indeed this is what physicist Matteo Billi writes in his graduation thesis (5):

"SNe are used in cosmology as distance indicators. In 1998, two research teams – the Supernova Cosmology Project and the High-z Supernova Search Team – conducted studies on a sample of SNe in far galaxies at $z = 0.2 \div 0.9$. From this study emerged that apparent brightness was typically less than 25% compared to the expected values. This indicates that these objects are at a greater brightness distance than that provided by universe models dominated by matter. This is how the evolution of a universe in a state of accelerated expansion was first determined."

For the formula given here, the factors by which absolute brightness (**L**) is divided in order to obtain apparent brightness (**I**) are the following:

1. Area of the sphere surface with a radius corresponding to the distance travelled by photons (**F**) relative to the locations progressively passed through (due to lack of horizontal space, this distance is not shown in the table, but corresponds to the speed of light, i.e. 7 billion light-years). This is because, as they move, photons are distributed on an ever-larger surface of the sphere, as its radius expands. However only the distance travelled by the photons, relative to the locations crossed, should be considered, and not the distance to which the locations move away from the galaxy's location due to space expansion, as this distance is considered in the second factor.

2. Ratio between the current distance (**d₁**) and the initial distance (**d₂**), raised to the cube. This ratio corresponds to the expansion of space during the journey (**E**), which is uniform in any location in the Universe and, therefore, even in the locations where the photons of the galaxy have transited - they are respectively the last and the first value, of the "distance -- progressive -- Earth locat." column (**M**).

The value of the ratio should be raised to the cube, as it is a volumetric expansion, which takes place on the three spatial dimensions.

Therefore, the formula is as follows:

$$I = \frac{L}{4\pi \cdot F^2 \cdot E^3}$$

and substituting the factor **E** with the factors related to the current and initial distances, we have the following formula (**formula 3.3.1**):

$$I = \frac{L}{4\pi \cdot F^2 \cdot \left(\frac{d_1}{d_0}\right)^3}$$

Whereas the formula used by the SC, as I found online (**4**), is the following (**formula 3.3.2**):

$$I = \frac{L}{4\pi \cdot D^2 \cdot (1 + z)^2}$$

Where "**D**" represents the current distance between the emitting and the receiving location.

Regarding the factor (1 + z), based on what I found online, it should be squared for the following reasons:

"- a factor is necessary to take into account the fact that every photon loses energy due to redshift;

- a second factor is due to the fact that the arrival rhythm of the photons also, is lower than the emission rate again for the same factor ".

Therefore the formula of SC considers the radius of the sphere as the current distance and not as the distance really traveled by photons (without the one that is due to the "tapis roulant" of the expansion), as justified in the explanation of my formula. Moreover the expansion factor sustained by the SC, is raise to the square rather than to the cube.

So compared to my formula, we have the factor **D** that has a greater value than the factor **F** and the factor that expresses the expansion of the space (**1 + z**) squared, which should correspond to a lower value than the **E** factor raised to the cube.

These differences should be due to different interpretations on the causes of the reduction of brightness that occurs during the photons' journey.

I would like to point out that the values of cosmological redshift (**0.59**) and current distance between the transmitting and receiving location (**8.68**) were derived from the paper by Zappalà (**2**) above, and relate to the photons issued 7 billion years ago by a celestial object.

I chose a redshift of 0.59 (and therefore the photons issued 7 billion years ago by a galaxy) as it is the closest value to the average between the minimum and maximum redshift mentioned in Matteo Billi's thesis (**3**), (0.2 ÷ 0.9). Therefore also 25% less brightness, as mentioned in the thesis, should apply, because it should correspond to an average of reductions in brightness.

To achieve the expansion of space during the photons' journey, I only need to use some factors of each of the two formulas, because the other factors are the same.

I point out that using only part of the denominator and the distance in billions of light years, I don't derive the real value of the apparent brightness, but an apparent brightness index, which I can use to make relationships between results related to apparent brightness, which I think it is sufficient to the purpose of this paper.

As for the SC's formula, the factors are those contained in the expression $D^2 \cdot (1 + z)^2$ from which it results:

$$8.68^2 \cdot (1 + 0.59)^2 = 75.3424 \cdot 2.5281 = \mathbf{190,473}$$

According to what reported in the graduation thesis of Billi (3), since from the observations it appears that the observed apparent brightness is 25% lower than the one calculated (naturally according to the formula of CS), I calculate its value increasing the latter by 25%.

$$190,473 \cdot 1,25\% = \mathbf{238,108}$$

I use this value to calculate the ratio between the current distance and the distance at the start of the photons, between the Earth and the starting location of photons and, therefore, the space expansion factor during the journey of the photons.

In the corresponding expression used by my formula, namely: $F^2 \cdot \left(\frac{d_1}{d_0}\right)^3$,

I value the known data and I get:

$$7^2 \cdot \left(\frac{8,536}{e^0}\right)^3 = \mathbf{238,108}$$

Then I divide the two members by 49 (7^2) and I extract the cubic root of the member to the right:

$$\left(\frac{8,536}{d_0}\right)^3 = \mathbf{4,859}$$

$$\left(\frac{8,536}{d_0}\right) = \mathbf{1,6937}$$

That constitutes the ratio of expansion of space (factor **E**) during the journey of photons of the galaxy.

Finally, with the last step

$$d_0 = \mathbf{5,040}$$

I get the distance between the location of the Earth and that of the galaxy that emitted photons, at the beginning of the journey.

Then I insert this distance into the table and thus I can complete the journey's simulation of the galaxy's photons, with the modality shown in the previous paragraph.

For further clarity, I will summarize the calculation method:

First I use the redshifts of the various periods, to simulate the journey of photons until their arrival on Earth, obtaining the distance traveled by photons including that due to space expansion which, in practice, corresponds to the current distance between the galaxy and the Earth.

Then, applying formula 3.3.1, I use the apparent brightness observed to calculate the distance between the galaxy and the Earth, at the start of the photons.

Finally I complete the simulation by changing dichotomically the speed in which the Earth was moving away from the galaxy, at the start of the photons.

In short, I use the redshifts to calculate the current distance and then I use the apparent brightness to calculate space expansion.

3.4 Simulation of the journey of photons of the Cosmic Microwave Background Radiation (CMBR)

According to the Big Bang theory, about 380,000 years after its expansion began, the space became transparent to radiation, and therefore a huge amount of photons began to propagate freely in it **(5, 6)**.

The photons started from different locations in the Universe and travelled in random directions. Therefore part of them travelled in the direction of the Earth's location.

Since then, said photons – known as CMBR – have continued to arrive at Earth, starting with those coming from the nearest locations, gradually followed by the farther ones.

During their journey, photons crossed locations which, due to space expansion, moved increasingly faster away from their starting locations and therefore increased their speed relative to said locations, until they reached the Earth's location at a speed of 300,000 km/s, however far greater than their starting locations.

And increasing speed also increased the redshift.

During this time, space has continued to expand and, consequently, the recession speed of the Earth's location from the starting location of CMBR photons, has increased.

Hence, also redshift has progressively increased to reach its present values of around 1,100.

Therefore, now, by applying the formula 3.2.2 shown in paragraph 3.2, the speed of the Earth's location relative to the starting locations of CMBR photons, is approximately 299,728 km/s at the time of their arrival at Earth.

$$v_r = 300000 - \frac{300,000}{(1 + 1,100)} = 299,728$$

In order to make a comparison, I also tried to simulate the journey of CMBR photons on the basis of the Universe model of the SC, and it is resulted a Universe radius that is much higher than that of the Universe model presented here and, in any case, an expansion speed in a very strong deceleration.

The difference in the length of the observable Universe radius, between the two Universe models, is due to the fact that in the present model it is used a formula of the Doppler shift, which sees the source motionless and the receiver in motion; while in the model of the Universe of the SC, it is used a formula that sees the receiver motionless and the source in motion, with the consequence that we obtain much higher expansion values, even if the SC considers the redshift as a factor of space expansion (see paragraph 3.2).

I also tried to simulate the speed of space expansion in acceleration, but it was not possible to get the arrive of CMBR photons at the Earth, which is a very important factor in favour of the hypothesis presented here.

I would like to give a final consideration on this simulation.

Since, as I wrote in chapter 2, the time speed varies according to the expansion of space and, therefore, towards the past it was flowing more rapidly, if there had been a clock that had always measured the time at the current speed (we could imagine it as outside the Universe), life of the Universe would have been less than 14 billion years. Naturally I made some simulations and it turned out that its life would have been less than 8 billion years.

3.5 Falsification of the Special Relativity

Below I will show that the fact that the observed apparent luminosity of type Ia supernovae, is less than the expected one, not only doesn't prove that the expansion of the Universe is accelerating, but also shows that the SR is not compatible with the observations and that, therefore, is falsified.

According to the graduation thesis mentioned in paragraph 3.3, for the galaxy object of the simulation in paragraph 3.2, the apparent brightness observed is about 25% lower than that expected, that is to that resulting from the application of the SC formula. This would indicate that the galaxy is at a greater distance than that foreseen by matter-dominated Universe models, for which the evidence of a rapidly expanding universe would be determined.

In other words, this would mean that the observed current distance of the galaxy would be greater than that resulting from the application of the apparent brightness formula, ie the expected one.

To better understand what it is, I set out below the calculation of the current distance knowing the initial one and the redshift.

$$\text{Current distance} = \text{Initial distance} \cdot (1 + z)$$
$$\text{Current distance} = 5,46 \cdot (1 + 0,59) = 8,68$$

which corresponds to the value shown in the Zappalà paper (2) as the current distance.

But if the current distance observed was really greater, it would mean, of course, that even the expansion of space would have been greater than that resulting using the factor $(1 + z)$.

But in this case also the redshift of the photons, and therefore the factor $(1 + z)$ itself, would have been greater than that considered, because the greater expansion of the space would be reflected also on the wavelength of the photons and, therefore, on the factor $(1 + z)$.

And so the current distance would have been greater.

But since the factor $(1 + z)$ is the observed one and cannot increase, not even the actual distance can increase.

So if the current distance is greater than expected, it can only mean that the factor $(1 + z)$ does not represent the expansion of space occurred during the photons' journey.

The same considerations also apply to the apparent brightness, even if the reasoning to do is a bit more complex. There it is.

As explained above, if the current distance were really greater, it would mean that the expansion of the space would have been greater than that resulting using the factor $(1 + z)$.

But in this case also the redshift of the photons would have been greater and therefore the factor $(1 + z)$ itself would have been greater.

Therefore, the values of the factors in the denominator of the formula, corresponding both to the current distance (which, as explained above, depends on the factor $(1 + z)$) and to the expansion of space $(1 + z)$, would also be greater, for which the total value of the denominator of the formula would be increased, reducing its result.

And so the expected apparent brightness would be less.

But since the factor $(1 + z)$ is the observed one and can not increase, not even the apparent brightness can decrease.

So if the observed apparent brightness is less than the expected one, it can only mean that the factor $(1 + z)$ does not represent the expansion of the space occurred during the photons' journey.

In conclusion, the above considerations demonstrate that the model of the Universe adopted, namely the fact that the Universe is or is not dominated by matter, has nothing to do with the fact that the apparent brightness observed is lower than the expected one, because these considerations apply to any model of the Universe.

Hence the reasoning that the fact that the apparent brightness observed is lower than the expected one, would show that the correct model of the Universe has not been adopted, is not valid.

Therefore the consequence of this reasoning is not valid either, that is, it is not true that the expansion of the Universe is in acceleration.

In support of my statement, I report what Professor Alberto Franceschini of the University of Padua has written about in one of his cosmology courses (7), where he rightly didn't justify this difference with the expansion of the Universe in acceleration: "A result not comprehensible with the physics we have used so far in our description of the Universe. We must probably resort to a new physics. "

In my opinion to justify the difference between the expected and observed brightness, it is necessary to find what is the factor that really represents the expansion of space during the trip, thing that I will do below.

As I demonstrated through a simulation of the journey to Earth of photons of a high-redshift galaxy, shown in section 3.2, the cosmological redshift is due to the recession speed of the location where the Earth is located at the reception of photons, in relation to the location where the photons were emitted, and must be used as a factor to calculate a speed and not as a factor to calculate an expansion of space.

In fact, in this simulation, which is based on a different Universe model from the one considered by SC, I used the cosmological redshifts of the various travel periods (with which I calculated the various recession speed), to calculate the current distance of the location where the Earth is located, from the location where the celestial object was located when has emitted the photons.

And then, taking into account the reduction in brightness due to the distance really traveled by the photons, I used the apparent brightness observed to calculate the factor of expansion of space occurred during the journey, a factor that has helped me to calculate the initial distance of the journey.

And, as can be seen from the simulation results shown at the end of this section, it has been found that the value of the space expansion factor is greater than the value of the last cosmological redshift of the simulation table, that the SC considers as the space expansion factor.

To calculate these speeds I applied the formula of the Doppler effect with the issuer stationary and the receiver in motion (as it is realistic to hypothesize based on the simulation), namely (formula 3.2.2):

$$v_r = c - \frac{c}{1 + z}$$

whereby the value 0.59 of z corresponds to a speed of move away of the receiver with respect to the issuer, of 111.321 km/s.

While according to the SR, for which each Reference Frame (RF) sees every other RF in motion with respect to itself (hence with a Ptolemaic and therefore unrealistic view of the Universe), the formula should be applied with the receiver stationary and the issuer in motion, namely:

$$\text{speed of source} = z \times c$$

so the value 0.59 of z corresponds to a speed of move away of the issuer with respect to the receiver, of 177,000 km/s.

However, this formula presents a big problem, because the observations show that photons coming from very distant celestial objects have redshifts with values much higher than 1 (up to more than 8).

Which would mean that their speed of move away would be much higher than that of light, phenomenon that is in contrast with SR (for which the speed of light cannot be overcome), and also impossible because in this case their light would not be able to get to Earth (this problem does not exist if we apply the formula with the issuer stationary and the receiver in motion, because the speed of the

receiver is always lower than that of the light, whatever the value of the redshift is).

Therefore, if we want to respect the SR, we cannot consider the redshift as due to the speed of move away of the issuer from the Earth.

In fact, the SC considered it as due directly to the expansion of space.

But so it turns out that the observed apparent brightness is lower than the expected one.

So since only if the cosmological redshift is considered as a factor of expansion of space, it is respected what claim the SR, the proof that it is not, falsifies the SR.

In conclusion, everything shows that the SR is falsified by the fact that the observed apparent brightness of the type Ia supernovae, is lower than the expected one.

Hereby I present the significant results for this paragraph, relating to the simulation set out in paragraph 3.2.

Initial distance = **5.04** billion light years;

Current distance = **8.54** billion light years;

F - distance traveled by photons = **7** billion light years;

(1 + z) - (last cosmological redshift, that the SC considers as space expansion factor) = **1.59**;

Space Expansion Factor = $1 + (8.54 - 5.04) : 5.04 = \mathbf{1.69}$.

The speed of expansion of space results in deceleration.

4. CONCLUSIONS

In this paper I have presented some hypotheses on certain physical phenomena in line with the theory on the motion related to the expansion of space (1), that I am briefly summarising here below.

4.1 Expansion of the Universe

The Universe is made up of an infinity of tiny particles of equal amount of space (a substance that has the tendency to expand), which I call "space quanta". Space quanta tend to expand unceasingly, thus causing the expansion of the Universe.

4.2 Gravity

Matter is made up of dynamic sets of compressed space quanta, which allow for a greater expansion of the neighbouring quanta and then, progressively, of the more distant ones.

Each material object tends to move to locations where space quanta are more expanded, i.e. towards other material objects.

4.3 Variable speed of light

Speed of light depends on the expansion of space quanta of the locations in which they transit. However since clocks also move in function of said expansion, if measured, both the speed and frequency of light results always the same.

Therefore, in the past, when space expansion was smaller, speed of light was greater.

4.4 Cosmological redshift

Cosmological redshift is due to the speed of the location of the celestial object receiving the photon, relative to the location of the celestial object that emitted it.

In support of this hypothesis, I have presented two tables that simulate the journey of the photons of a high-redshift galaxy and that of CMBR photons, and a formula for calculating the apparent brightness of a high-redshift celestial object, to derive space expansion occurred during the journey of the photons towards the Earth.

All of this proves that the expansion speed of the Universe is decelerating and not accelerating, as currently supported by the SC based on its model of the Universe.

Furthermore, it is shown that the SR is not compatible with the observations and that, therefore, is falsified.

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