

Each Point of Space in Expansion is the Preferred Reference Frame for any Object Transiting to that Point

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ABSTRACT

The aim of this paper is to demonstrate, by means of CMBR, a theory which states that the speed of light is isotropic with respect to each point in expanding space, so it cannot also be isotropic with respect to transiting objects.

Hence the result found by Michelson-Morley experiment, which showed that the speed of light is isotropic in any Reference Frame, is due to the phenomenon suggested by Lorentz, i.e., that each object undergoes a contraction of its length and a dilation of its time as a function of its speed with respect to the points it passes through, which, therefore, constitutes its preferred Reference Frame.

Hence now Special Relativity is complementable with a theory for which light waves are manifested in a medium (and not in a vacuum) and their speed is not isotropic in all Reference Frames, no matter what their speed is, a frame with respect to an other frame. It is a theory that opens another path to the truth about the workings of the Universe.

Keywords:

CMBR, Cosmic Microwave Background Radiation, dipole anisotropy, preferred Reference Frame, speed of light, Special Relativity, Lorentz, Michelson-Morley experiment, expansion of space.

1. INTRODUCTION

In 1887, the famous Michelson-Morley (MM) experiment was carried out, which was to detect the so-called aether wind, that would be due to the motion of the Earth against the aether. That is, the medium in which the light would manifest itself and with respect to which its speed would be isotropic.

This is why the aether would have been regarded as the preferred Reference Frame (RF) .

The experiment, however, revealed that the speed of light appeared isotropic with respect to the Earth and, therefore, did not reveal any aether wind and subsequently no aether, either (1).

In order to justify this negative result, Lorentz hypothesized that all objects that move in the aether, undergo a contraction in the direction of motion and a slowing of time, thus making the speed of light result isotropic, while in reality it was not (2).

Einstein, however, did not accept this justification and, without the aether, in 1905 formulated the theory of Special Relativity (SR), with which he hypothesized that the light waves propagate in a vacuum and that their speed is isotropic in all the RFs, whatever the movement between them.

These hypotheses are at least difficult to accept, both because the waves are in need of a means to manifest themselves (Einstein himself later modified his convictions on this hypothesis (3)), and because if the speed of light is isotropic in a RF, it cannot also be isotropic for the RFs that move in different way.

In order to justify the latter case, Einstein claimed that the isotropy of the speed of light "is in reality neither a supposition nor a hypothesis about the physical nature of light,

but a stipulation which I can make of my own free will in order to arrive at a definition of simultaneity" (4).

So Einstein supposed that the speed of light is isotropic in all RFs, not because it actually can be, but as a stipulation.

But now, as I will show below, it is possible to detect the preferred RF, namely the one in which the speed of light is actually isotropic, thus allowing to consider how true, both the slowing of time and the objects' contracting length, depending on their speed, as hypothesised by Lorentz.

This makes SR complementable with a theory that is not based on the above mentioned stipulation. A theory in which light waves are manifested in a medium and in which their speed is not isotropic in all the RFs, whatever the movement between them. A theory from which further theories can be derived regarding various phenomena of the Universe and that, therefore, opens another path towards the truth about how the Universe works.

2. DEMONSTRATIONS

2.1 Demonstration using Cosmic Microwave Background Radiation (CMBR)

It can be seen from observations, that space, which is considered here as a "substance" in which both photons and matter manifest themselves, is expanding throughout the Universe. According to the Big Bang theory, about 379,000 years after the beginning of its expansion, the Universe became transparent to radiation, so a huge amount of photons began to spread freely (5,6).

Photons were released from different parts of the Universe and have travelled in random directions, so some of them travelled towards Earth.

Since then these photons, which are referred to as CMBR, have continued to reach Earth, starting with those being released from the closest points and then gradually more and more distant ones.

Due to the expansion of space, their wavelength has greatly increased, and therefore their frequency has decreased to the currently detected value (about 1,100 times), which is the same for all photons, except for some very slight anisotropies (around one in 100,000) (5).

In addition to these anisotropies, which are intrinsic in nature for CMBR (being of intrinsic nature, they do not affect the present theory and, therefore, for simplicity will not always be considered in this paper), it has been detected a particular anisotropy of much greater amplitude than the other (around one in 1,000) (4), which depends on the direction of the CMBR's provenance and that is due to the motion of the Earth (about 300 km/s) with respect to a particular point at which this anisotropy would not be detected, called "dipole anisotropy" (7).

Hence in that point the CMBR's frequency would be isotropic or, more precisely, would not be affected by the dipole anisotropy. But then its speed would also be isotropic, since the MM experiment proved that the speed of photons (including those of the CMBR) is isotropic in any RF in which it is measured.

Therefore, in this point both the speed and the frequency of the CMBR would be isotropic, as is realistically reasonable. Because it is not acceptable to assume that the frequency of the CMBR depends on its direction of origin and that, at the same time, its speed does not depend on the direction of origin and is, therefore, isotropic (see the next section for a demonstration of this statement).

So if on Earth it appears that the frequency of CMBR depends on its direction of origin and, on the other hand, that its speed is isotropic, one of the two measurements is not correct.

The point at which both the speed and frequency of the CMBR would be isotropic, can be only that where the dipole anisotropy is measured, i.e., that where the Earth is transiting in the moment of measurement.

But if at this point the speed of the CMBR photons is actually isotropic, the speed of all the other photons, including light photons, must therefore be isotropic. And if the speed of the photons is isotropic with respect to the point they are traversing, it cannot be isotropic with respect to the Earth, as the Earth is in motion with respect to that point.

The speed of the photons cannot be isotropic even compared to points other than that in which the photons are traversing, since due to the expansion of space the other points are moving away from said point and, therefore, are in motion with respect to it (this reasoning will be covered in greater depth in the next section).

In conclusion, if on Earth the speed of the photons appears isotropic, as in the experiment of MM, it only means that the tools available on Earth are not able to measure it properly for the reasons suggested by Lorentz, and not that it really is isotropic (2).

Therefore the speed of the photons is isotropic only with respect to points in space where the Earth is moving, which therefore constitutes its preferred RF.

2.2 Demonstration through thought experiments

To demonstrate the hypotheses set out above more clearly, two thought experiments are presented below.

Imagine the expanding Universe as a big rubber ball that is being continuously inflated, with many points marked on its surface (representing points in space). Now imagine CMBR photons as a set of cars that move on its surface at a constant speed, let's say 1 m/s.

Note that if the speed of a car is 1 m/s with respect to the point in which it is travelling, it cannot also be 1 m/s with respect to the other points, since they are moving away from that point due to the expansion of the sphere's surface. So in order to determine its speed with respect to one of the other points, it is necessary to add or subtract from 1 m/s, the speed of this 'moving away' of the point concerned, according to the direction of motion of the car with respect to this point. Consequently, with respect to this point, the cars that go in the direction opposite to that of the 'moving away' of the point, have a speed greater than 1 m/s, and those that go in the same direction as the point, have a speed less than 1 m/s. So the speed of the cars transiting in a determined point is not isotropic with respect to another point. At this other point, of course, the speed of the cars that pass through it, is isotropic.

Imagine then an RF as a pickup truck that moves on the surface of the sphere, but at a lower speed than 1 m/s, and let us suppose that it is able to measure its speed against the cars. It would be revealed that the cars approach the truck at different speeds depending on the direction, and with suitable calculations it would be possible to determine its speed with respect to the point it is traversing.

For example, if the speed of only two of the cars coming from opposite directions was measured by the truck, and these were respectively 0.9 and 1.1 m/s, the difference would be 0.2 m/s and its speed with respect to this point would be half, i.e., 0.1 m/s.

But if the truck measured a speed of 1 m/s for both of the cars (which would represent the MM experiment), it would mean that it does not have adequate tools to detect the exact speed and not that the cars are really moving towards it at a speed of 1 m/s, as this would be impossible.

Now I'll present another thought experiment which is only slightly more complex.

Let us assume that in a certain point marked on the sphere, two lines of cars are passing through coming from opposite directions and with the cars in each line spaced 0.1 metre apart.

In one second an observer positioned at that point would count 10 cars coming from one direction and 10 from the other, and would measure a speed of 1 m/s for each of them. Therefore both the frequency of the cars and their speed would be isotropic.

Now, assuming that the truck always moves at a speed of 0.1 m/s in one of the two directions, in one second it would count 11 cars coming from the direction in which it is moving, and 9 cars coming from the opposite direction. So it would detect a difference of two cars between the two directions of origin (the difference represents the dipole anisotropy of CMBR). And if it accurately measured the speed of the cars with respect to itself, it would find that those coming from the forward direction would have a speed of 1.1 m/s, while those coming from behind would have a speed of 0.9 m/s.

Therefore, both the frequency and the speed of the cars would depend on the direction of origin and, therefore, would be anisotropic.

But if it measured their speed isotropic (1 m/s) and their frequency anisotropic (11 and 9), it would mean that one of the two measurements was incorrect, namely that of the speed as shown in the previous experiment.

In conclusion, it appears that the speed of the cars is actually isotropic only with respect to the point which they are traversing, which therefore is the preferred RF for the pickup truck.

For completeness it should be added that, of course, every point the truck will pass during its journey will be its preferred RF at the moment of transit, but will cease to be so once it has been passed.

3. DEVELOPMENTS

3.1 Time and length

From the demonstrations above it is possible to deduce the laws of physics that follow.

Each point in space has its own time, which we will call local time.

For a moving object at a certain point, the time would correspond to the dilated local time as a function of its speed relative to that point, and is obtained by applying the Lorentz time dilation formula (the formulae are shown in the next section).

Therefore, knowing the time of the object, the local time can be found by applying the Lorentz time dilation formula in reverse.

A hypothetical object at rest with respect to a point in space, would assume the maximum length.

A moving object at the point would be subjected to a contraction of its length in the direction of its motion depending on its speed compared to the point. The contracted length is given by the Lorentz formula of length contraction.

Therefore, knowing the contracted length, it is possible to obtain the maximum length using the inverse of the Lorentz length contraction formula.

The tool for measuring the speed of the object with respect to the point it is passing, uses the dipole anisotropy of CMBR.

3.2 The Lorentz Formulae

The Lorentz formulae are two simple mathematical formulae, plus the relevant inverse formulae, which Lorentz used to justify the negative result of the MM experiment.

Definitions

We define S_0 as a hypothetical preferred RF, i.e., a particular point in space.

We define S1 as an RF that is transiting in S0.

t = time

x = length

c = speed of light

v = speed with respect to S0

Factor of contraction and/or expansion

$$R = \sqrt{1 - \frac{v^2}{c^2}}$$

Time dilation: calculation of the time on a clock positioned at S1, knowing the time of a clock at S0 (local time).

$$t_1 = t_0 * R$$

Time dilation, inverse: calculation of the time on a clock placed at S0 (local time), knowing the time of a clock placed at S1.

$$t_0 = \frac{t_1}{R}$$

Contraction of the lengths: calculation of the length of an object at S1, knowing the length of the object at S0.

$$x_0 = x_1 * R$$

If measured in S1, however, the object will be the same length, because the ruler used to measure it will also contract.

Length contraction, inverse: calculation of the length of an object placed at S0, knowing the length of the object at S1.

$$x_1 = \frac{x_0}{R}$$

3.3 Differences from Special Relativity

There are some differences compared to SR, which are explained below.

In this theory the speed of the photons is isotropic only with respect to the point they are passing.

In the SR theory it is also isotropic with respect to objects which are in transit at that point.

In the present theory, each object conforms as a function of its speed relative to that point in the space in which it is moving, in the sense that its length decrease and its time dilates.

In SR, each object observes other objects which decreases its length and expands their time, according to their speed with respect to itself.

4. CONCLUSIONS

The speed of light relative to the Earth cannot be isotropic for the reasons that follow.

1. As is clear from the "Demonstrations through thought experiments", for the speed of the CMBR photons to be isotropic, their frequency must also appear isotropic. Given that on Earth their frequency is not isotropic, but depends on the direction, their speed cannot be isotropic, because it too must depend on the direction of origin.

2. As shown by the "Demonstrations using background radiation", in the point in space traversed by the Earth, both the speed and the frequency of the CMBR photons are isotropic. This means that their speed is in fact isotropic, so it cannot also be truly isotropic with respect to the Earth, since the Earth is moving at a speed of about 300 km/s.

Of course what applies to the photons of the CMBR also applies to all other photons.

In conclusion, if on Earth the speed of the photons appears isotropic, as in the experiment of MM, it only means that the tools available on Earth are not able to measure it properly for the reasons suggested by Lorentz, and not that it really is isotropic.

Therefore the speed of the photons is isotropic only with respect to the points in space they pass through, which can then be defined as the preferred RFs for any objects that pass through them.

From these demonstrations a theory can be derived, which states that for each object and at any time, there is a preferred RF which consists of the points in space where it passes through, with respect to which:

- the speed of the photons is isotropic;
- the object can measure its speed;
- the object is contracted as a function of its speed;
- the time in the object dilates as a function of its speed.

The tool for measuring said speed is the dipole anisotropy of CMBR.

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