THEORY ON THE MOTION RELATED TO THE EXPANDING SPACE

Dino Bruniera
Treviso (Italy)
e-mail: dino.bruniera@gmail.com

ABSTRACT

With this article I propose to demonstrate, through the CMBR, a theory for which the light is manifested in the expanding space, so its speed is isotropic only towards it and not towards the celestial objects in motion respect to it.
Hence the result found by Michelson-Morley experiment, which showed that the speed of light is isotropic in any Reference Frame, is given by 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 medium in witch the light is manifested, which in this theory corresponds to the expanding space.
Hence now Special Relativity is replaceable with a theory for which light waves are manifested in space and their speed is not isotropic in all Reference Frames.

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

1. INTRODUCTION

The Einstein's theory of Special Relativity (SR) is a "Ptolemaic" theory, and therefore cannot be compatible with reality, as it establishes that each Reference Frame (RF) considers itself as the center of the Universe and that the speed of light is isotropic towards itself.
Furthermore, I want to present a theory more compatible with reality, as it foresees that the speed of light is really isotropic only respect to the expanding space and, therefore, not respect to any celestial object in motion towards it.

2. DEMONSTRATION THAT SPECIAL RELATIVITY ISN’T COMPATIBLE WITH REALITY

In 1887 the famous Michelson-Morley (MM) experiment was carried out in order to detect the so-called aether wind, that would be due to the motion of the Earth relative to 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 RF .
The experiment, however, revealed that the speed of light appeared isotropic with respect to the Earth and, therefore, didn’t 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, didn't accept this justification and, without the aether, in 1905 formulated the theory of SR, with which he hypothesized that the light waves propagate in a vacuum and that their speed is isotropic in all the RFs.

These hypotheses aren't realistic, above all because the waves need a medium to manifest themselves so that their speed can be isotropic only with respect to said medium, as is the speed of sound relative to air.
Einstein himself, in 1920, modified his convictions on this hypothesis, saying that one can accept "the introduction of a medium that fills the space and assume that the electromagnetic fields are its states" (**3**), but without justify how it is possible that this medium isn't considered to be the privileged RF, i.e. the only one with respect to which the speed of light is really isotropic.
However 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 really can be so, but because it is a stipulation.

Despite this clarification by Einstein, the SR was accepted as conforming to the reality by the Scientific Community, probably above all for its compatibility with the General Relativity (GR), which provided a gravity law more adherent with the observations, compared to that provided by Newton.
But this hypothesis involves a rather "Ptolemaic" view of the Universe, and therefore not realistic, as each RF considers itself stationary and all the other RFs in motion with respect to itself and, therefore, considers itself as the center of the Universe.

3. MOTION RELATED TO THE EXPANDING SPACE

3.1 Exposition

A more realistic view is that which foresees that the speed of light is isotropic only towards the medium in which it manifests itself, which consists of the only substance that makes up the Universe and corresponds to what is called as space.
In this article I referred to the medium in which light is manifested as "space", but I could also call it "aether" or, even better, "apeiron", which is the term that about 26 centuries ago, the greek philosopher Anaximandro used to call the primordial substance.
Even two important physicists, such as Werner Heisenberg and Max Born, have hypothesized that the Universe is composed of a single substance in which both the light and any other elementary particle would manifest, as shown by Wikipedia:
Werner Heisenberg, noted for the creation of quantum mechanics, arrived at the idea that the elementary particles are to be seen as different manifestations, dif-

ferent quantum states, of one and the same "primordial substance". Because of its similarity to the primordial substance hypothesized by Anaximander, his colleague Max Born called this substance apeiron.

The theory that I present isn't based on the above-mentioned unrealistic "Ptolemaic" conventions of the SR, but on a realistic convention, for which the location of the expanding space in which a celestial object is passing, is considered as the privileged RF, that is, the one in which the speed of light passing near the object is truly isotropic.
This theory is compatible with Lorentz's Ether Theory (LET) and, therefore, also with its justifications of the results of the various experiments on the speed of light, including that of MM.
Moreover from it we can derive some hypotheses on the various phenomena of the Universe, such as its expansion, gravity, the speed of light, the cosmological redshift and the apparent brightness of the high-redshift celestial objects, in a way that is more compatible with the observations, making a comparison to those currently supported by the Scientific Community.
I have exposed these hypotheses in a specific article that I propose to publish as soon as possible.

3.2 Identification of the privileged Reference Frame

It can be seen from observations, that space, which I consider 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 space became transparent to radiation, so a huge amount of photons began to spread freely (**5, 6**). So that, unlike the other photons, which are emitted by celestial objects in motion with respect to the space, it is as if they had been emitted from the space itself. Therefore, since the frequency of the photons is isotropic only towards the transmitter, they are the only photons whose frequency is almost isotropic towards the space.
Photons were released from different locations of the space and have travelled in random directions, so some of them travelled towards Earth.
Since then these photons, which are referred to as CMBR (Cosmic Microwave Background Radiation), have continued to reach Earth, starting with those being released from the closest locations 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, it has been detected a particular anisotropy of much greater amplitude than the others (around one in 1,000), which depends on the direction of the CMBR's provenance and that is due to the motion of the Earth (about 370 km/s) with respect to a particular location in which this anisotropy would not be detected, called "dipole anisotropy" (**7**).

Hence in that location the CMBR's frequency would be isotropic (without considering the aforementioned very slight anisotropies) or, more precisely, would not be affected by the dipole anisotropy. As can be expected from the fact that said photons are as if they were emitted from the space itself, as I have shown above. Also its speed is isotropic, because this location is part of the space and, therefore, of the medium in which the photons are manifested.
Therefore, in this location both the speed and the frequency of the CMBR (without considering the aforementioned very slight anisotropies) would be isotropic, as it should be and as it will be shown in the next paragraph.
That location can be only the one where the frequency of the CMBR is measured, i.e., the one where the Earth is transiting in the moment of measurement.

The speed of the photons cannot be isotropic even compared to locations other than that in which the photons are traversing, because due to the expansion of space, the other locations are moving away from said location and, therefore, are in motion with respect to it (this reasoning will be covered in greater depth in the next section).
Therefore, as regards to the Earth, the speed of the photons is isotropic only with respect to locations in space where the Earth is moving, which therefore constitutes its preferred RF.
The speed at which the Earth is moving with respect to its privileged RF is determined by the value of the dipole anisotropy.
Naturally every celestial object will have its privileged RF, which corresponds to the location in space in which it is moving.

3.3 Exposure of the Universe model through thought experiments

Imagine the expanding space as a big rubber ball that is being continuously inflated, with many points marked on its surface (representing locations 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 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 isn't 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 possible 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 doesn't 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.

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.

4. DEVELOPMENTS

4.1 Time and length

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

Each location in space has its own time, which we will call local time.
For a moving object at a certain location, the time would correspond to the dilated local time as a function of its speed relative to that location, 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 location in space, would assume the maximum length.
A moving object at the location would be subjected to a contraction of its length in the direction of its motion, depending on its speed compared to the location. 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 location it is passing, uses the dipole anisotropy of CMBR.

4.2 The Lorentz Formulae

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

Definitions

I define $\mathbf{S_0}$ as a hypothetical preferred RF, i.e., a particular location in space.
I define $\mathbf{S_1}$ as an RF that is transiting in $\mathbf{S_0}$.

t = time
l = length
c = speed of light
v = speed with respect to $\mathbf{S_0}$

Factor of contraction and/or expansion

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

Time dilation: calculation of the time on a clock positioned at S1, knowing the time of a clock at $\mathbf{S_0}$ (local time).

$$\mathbf{t_1} = \mathbf{t_0} \cdot \mathbf{R}$$

Time dilation, inverse: calculation of the time on a clock placed at $\mathbf{S_0}$ (local time), knowing the time of a clock placed at $\mathbf{S_1}$.

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

Contraction of the lengths: calculation of the length of an object at $\mathbf{S_1}$, knowing the length of the object at $\mathbf{S_0}$.

$$\mathbf{l_1} = \mathbf{l_0} \cdot \mathbf{R}$$

If measured in $\mathbf{S_1}$, 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 $\mathbf{S_0}$, knowing the length of the object at $\mathbf{S_1}$.

$$\mathbf{l_0 = \frac{l_1}{R}}$$

4.3 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 location they are passing.
In the SR theory it is also isotropic with respect to objects which are in transit at that location.

In the present theory, each object conforms as a function of its speed relative to that location 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 decrees its length and dilates their time, according to their speed with respect to itself.

5. CONCLUSIONS

The speed of light relative to the Earth, cannot be isotropic for the reasons that follow.
1. As it is clear from the explanation through thought experiments (paragraph 3.3), for the speed of the CMBR photons to be isotropic, their frequency (without considering the aforementioned very slight anisotropies) must also appear isotropic. Than given that on Earth their frequency isn't isotropic, but depends on the direction of origin, their speed cannot be isotropic, because it too must depend on the direction of origin.
2. From what emerges from the paragraph on the identification of the privileged RF (3.2), in the location in space traversed by the Earth, both the speed and the frequency (without considering the aforementioned very slight anisotropies) 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 370 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 aren't 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 locations 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 locations 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.

REFERENCES

1. Max Born – La sintesi einsteiniana – Chapter 5, paragraph 14 - "L'esperimento di Michelson e Morley". 1973; 257-262.
2. Max Born – La sintesi einsteiniana – Chapter 5, paragraph 15 – "L'ipotesi della contrazione". 1973; 262-269.
3. Albert Einstein – Morgan manuscript – paragraph 13 – 1920;
4. Albert Einstein – Relatività: Esposizione divulgativa – Chapter 1, paragraph 8 – "Sul concetto di tempo nella fisica". 1996; 58-61.
5. Wikipedia, edizione italiana – Radiazione di fondo – Caratteristiche.
6. Amedeo Balbi – La musica del Big Bang – Chapter 2, Paragraph "Il lungo addio". 2007; 54-60.
7. Amedeo Balbi – La musica del Big Bang – Chapter 3, Paragraph "I giganti del cosmo". 2007, 80-85.