Special Relativity sans Lorentz Transformation (OR) Perceptional Relativity

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Special Relativity sans Lorentz Transformation (OR)  
Perceptional Relativity

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Abstract:
This paper shows that if we accept that there is no absolute perception of Reality and the same Reality is perceived differently by different observers, then a simple and straightforward explanation for the constancy of Light's speed in all inertial frames of reference is possible without any need for paradoxical Lorentz Transformation. This paper also proves that Lorentz Transformation, as incorporated in the Special Theory of Relativity, is conceptually flawed. This paper also points out the misconceptions regarding the claimed experimental verifications of Lorentz Transformation's predictions in the Hafele–Keating experiment and μ meson experiment. This paper concludes that Einstein's Special Theory Relativity can stand on its own merits without Lorentz Transformation.

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1. Introduction

Everyone's world is his or her perception. Any absolute reality beyond the perceptional realities of the observers seems to be beyond the cognitive limits of human capabilities.
But, fortunately for all human beings, though their perceived 'facts' may differ, the laws of Nature connecting one's perceived 'facts' are the same. A stone's trajectory dropped by a passenger in a moving train is a straight line for him, whereas it is a parabola for an observer standing on the platform. Both observers would agree that the same laws of Physics govern the physical realities perceived by them. The First Postulate of Special Relativity succinctly states this fact as follows: "The laws of nature have the same mathematical form in all inertial reference frames" \([1]\). Though the laws are the same, the scenarios of the same reality observed in different inertial frames need not be the same as has been exemplified by the stone's trajectory being a straight line in the train frame and a parabola in the platform frame. This paper is a relook of Special Relativity in the Light of Perceptual Relativity, which means that the same reality is perceived differently by the observers stationed in different inertial frames. There is no absolute perception of that reality.

The rest of this paper consists of the following four parts, namely-

I. **An explanation for the constancy of the Speed of Light in all inertial frames, based on Perceptual Relativity,**

II. **Conceptual flaws of Lorentz Transformation,**

III. **The Concept of Time in Lorentz Transformation**

IV. **Experimental Results disprove Lorentz, Transformation,**

V. **Lorentz Transformation is unnecessary in Special Relativity.**
PART – I

An explanation for the constancy of the Speed of Light in all inertial frames, based on Perceptual Relativity

1.1 Space is stationary in every Frame.

The following two premises constitute the whole gamut of Physics.

1. The Laws of Physics have been discovered and derived from an observer's perspective while that observer rests in an inertial frame of reference.

2. Space is at rest relative to the observer's Frame of reference, and all other inertial frames are moving in that Space.

The second premise ensures the certainty of measurements of the distances in Space travelled by the moving objects, which is not guaranteed when Space also is moving relative to the observer.

Space is static in his Frame for any observer, and the other frames move in that Space. Just like there is a common perception of the stationary observers in every Frame that their Frame alone is at rest while all other frames are moving, those observers share another common perception that Space is at rest in their Frame. Since an observer observes that the objects attached to his Frame are at rest and Space is static, he assumes that Space is also linked to his reference frame. This perception implies that any Point in Space can be claimed to be attached to his Frame of reference by any observer regardless of his motion relative to other observers. It may be that there are infinite Spaces – each
one belonging to one Inertial Frame, or one single Space perceived as being static in his Frame by every observer.

Einstein did not rule out the possibility of an infinite number of Spaces in motion relative to each other. It is evident from the following extract from the book "Relativity – The Special and the General Theory," written by him. (Fifteenth Edition Appendix 5 "Relativity and the Problem of Space" – Pigeon - First Indian Edition 2008 – Page 145 [2]):

"But it must now be remembered that there is an infinite number of spaces, which are in motion with respect to each other. The concept of Space as something existing objectively and independent of things belongs to pre-scientific thought, but not so the idea of an infinite number of spaces in motion relatively to each other. This latter idea is indeed logically unavoidable but is far from having played a considerable role even in scientific thought." (emphasis supplied).

1.2 For any observer, any Light source is at rest in his Frame alone.

Now, let us consider a point anywhere in the entire Space from which Light originates. The spatial location of the Light emitter is the point in Space from where the Light originates. The emitter's speed is immaterial since it is a verified fact that the speed of the emitter is not passed on to the Emitted Light, and hence the Speed of Light is independent of the speed of the emitter. The spatial location of the emitter is, instantaneously, the point in Space from where Light emanates. An observer intending to measure Light's
speed has to place a material marker, say $O$, at the Light-Emitter's spatial location to fix Light's starting point. Obviously, that marker will remain stationary in his Frame. An observer in another frame of reference can also place another marker, say $O'$, at the same point, and that marker will remain stationary in that Frame. There will undoubtedly be relative displacement between the two markers after that instant of time. Still, each observer will assume that his marker has remained at the Same point in Space while the other marker has been moving. Thus, every observer can claim that the light source is stationary in and attached to his Frame.

### 1.3 An observer detects Light using a Light Detector that is at rest in his Frame alone.

Any Light Detector, any material object for that matter, is at rest in only one inertial Frame, and it is moving relative to all other frames. The clock of that Light Detector is synchronized with the other clocks attached to its Frame. For any particular instant of time, all the clocks attached to his Frame would show an identical time, whereas, if Lorentz Transformation were true, the clocks attached to any other fame would appear to be non-synchronized, each clock living in a different instant of time. This scenario implies that for measuring the Speed of Light in his Frame, the observer has to use the Light Detector attached to his Frame to ensure recording of correct durations of time according to his Frame. Let alone Lorentz Transformation, since every observer perceives that the light source is stationary in and attached to his Frame (as has been discussed in the previous paragraph), the Light Detector attached to his Frame at a constant distance, say $x$ meters, from the Light Source, would receive the Light signal that had originated from the Light Source $x/c$ seconds before such detection. Since any
Light Detector cannot detect any Light Signal that approaches it with speed relating to it being not equal \( c \) in violation of the Principle of Constancy of the Speed of Light, it would detect only the Light Signals originating from the Light Sources attached to its Frame. This reality means that the material marker representing the Light Source's spatial point is at rest relative to the Light Detector.

In fine, for any detection of Light by any observer, he has to ensure that both the Light Source and the Light Detector are attached to his Frame of Reference.

1.4 For any observer, Light spreads in his Frame alone.

There is an infinite number of inertial frames of reference – each Frame moving with a non-zero velocity relative to any other frame. When a spherical electromagnetic wave propagates with a speed \( c \) from a Space point in all directions, it spreads in each of the infinite inertial frames of reference. But, for an observer in any one of those frames, his perceived facts are the following:

1. The spatial point from which the light wave has started propagating is stationary in and attached to his Frame (i.e., Space itself is attached to his Frame);

2. The light wave propagates in the Space which is attached to his Frame; and

3. His detection of Light Signals is confined to those originating from Light Sources attached to his Frame and reaching the Light Detectors attached to his Frame. The light waves propagating in 'spaces' of other frames, if any, are beyond his perception and hence of no concern to him.
Suppose the velocity of a moving material particle (i.e., a particle having mass) relative to a frame of reference is known. In that case, to calculate the particle's velocity relative to another frame of reference, we have to use the **Law of Addition of Velocities**. But, in the case of transmission of Light, for any observer, Light spreads only in his Frame, and he is immune from the perception of or any impact from Light Waves, if any, spreading in other frames and hence there is no question of calculating the speed of Light in any different frame relative to him. **Accordingly, the Law of Addition of velocities has no relevance to the Speed of Light.**

### 1.5 What is the Correct Explanation for the Constancy of the Speed of Light in all inertial frames of reference?

Let us visualize two rectangular slabs, \( S \) and \( S' \), resembling Light Clocks with one end fitted with the Light Sources \( O \) and \( O' \) and the other end with Light Detectors \( D \) and \( D' \) respectively. Let both slabs be of an identical length, say \( L \). Let the two slabs rest relative to one another. When the Light travels from the Source to the Detector, it spans the same distance \( L \) during the same time interval \( L/c \) in both slabs (\( c \) is the universal constant of the speed of Light for any observer.)

Let the two frames be set in a relatively uniform linear motion along the horizontal axis with a constant relative velocity equal to \( v \) m/s. Now, the two slabs \( S \) and \( S' \) constitute two different inertial frames of reference. The stationary observers in each Frame perceive that their Frame continues to be in the same state of rest, and only the other frame has started moving. From each Frame's stationary observers' perspective, nothing has changed as far as their Frame is concerned, and Light covers the same length \( L \) of their
Slab in the same \( \text{L/c} \) seconds. The perceptions of the observers in the two frames are as follows:

Let a Light pulse starts from the Light Source \( \text{O} \) and the Light Source \( \text{O'} \) simultaneously when the instant of time is counted as \( \text{0} \) in both frames \( \text{S} \) and \( \text{S'} \). The scenarios from the viewpoint of \( \text{S} \) and \( \text{S'} \) starting from this instant have been depicted below.

(i) **At the instant when a Light Signal originates from a spatial point where the material markers representing Light Sources \( \text{O} \) and \( \text{O'} \) coincide**
(ii) At the instant when a Light Signal reaches the Light Detector

(a) From the perspective of the Frame S

The stationary observers of Frame S make the following observations -

(1) The Light Signal originated from the Light Source O when \( t = 0 \), is detected by the Light Detector D.

(2) While their Frame has been remaining at rest occupying the same part of the Space, the Slab of the other frame S' has moved in the Space towards the right through a distance \( vt \) and occupied a different part of the Space.

They cannot make any observation regarding detection of Light by the Light Detector D' attached to a different frame. Any Light Detector attached to the other frame S' cannot detect Light originating from Light Source O not attached to that Frame.
(ii) At the instant when a Light Signal reaches the Light Detector

(b) From the perspective of Frame S'

The stationary observers of the Frame S' make the following observations, -

(1) The Light Signal originated from the Light Source O' when \( t = 0 \), is detected by the Light Detector D'.

(2) While their Frame has been remaining at rest, occupying the same part of the Space, the Slab of the other Frame S has moved in the Space towards left through a distance \( vt \) and occupied a different part of the Space.

They cannot observe the detection of Light by the Light Detector D attached to a different frame. Any Light Detector attached to the other frame S cannot detect Light originating from Light Source O' not attached to that Frame.
For the static observers in both frames $S$ and $S'$, the Light covered the distance $L$ during the time interval $t$ so that the speed of Light is $L/t$, i.e., $c$. Regardless of relative displacements between Light Sources $O$ and $O'$ and between Light Detectors $D$ and $D'$, both observers would measure Light's Speed to be $c$.

Any Light Detector can detect Light originating from a light source that is at rest in the same Frame in which it is also at rest. It follows that no static observer in an inertial frame detects Light that has originated from a Light Source that is not at rest relative to his Frame. To make this fact amply clear, we may adopt the following statement as the Third Postulate of the Special Theory of Relativity (STR) in place of Lorentz Transformation.

"The detection of light by an inertial reference frame is an event that is exclusive to that frame."

The above statement implies that the Speed of Light relative to any inertial reference frame cannot be measured by any observer who is not stationary in that Frame. The Constancy of the Speed of Light measured in all frames of references is due to each observer's perceptions that Space is at rest relative to his Frame of Reference, and the light source and the light Detector are static in his Frame of reference.

Space is the medium for the transmission of electromagnetic waves. The speed of the propagation of electromagnetic waves relative to Space is $c$, a constant. Since Space is at rest in any inertial frame of reference, the speed of the transmission of electromagnetic waves relative to any inertial frame of reference is also $c$. Thus, we have derived a
precise explanation for the Speed of Light's constancy measured in all frames of references without 'torturing' the observers' measuring rods and clocks.

PART – II
Conceptual Flaws of Lorentz Transformation

2.1 What is the Lorentz Transformation?
In the First Part of this Paper explaining the Speed of Light's constancy, we visualized two rectangular slabs, \( S \) and \( S' \) resembling Light Clocks with one end fitted with the Light Sources \( O \) and \( O' \) and the other end with Light Detectors \( D \) and \( D' \) respectively. In that explanation, the two slabs were of an identical length, say \( L \). But, now in our discussion about Lorentz Transformation, we take the length of the slabs, say \( S \) as \( x \) and that of the other slab \( S' \) as \( x' \), when they were at rest relative to one another.
Let the two frames be set in a relatively uniform linear motion along the horizontal axis with a constant relative velocity equal to $v$ m/s. Now, the two slabs $S$ and $S'$ constitute two different inertial frames of reference. The stationary observers in each Frame perceive that their Frame continues to be in the same state of rest, and only the other frame has started moving. From the perspective of each Frame's stationary observers, as far as their Frame is concerned, nothing has changed, including the length of the Slab; but, the length of the Slab of the other Frame has contracted by a factor $a$, which is called **Lorentz Factor**. The following discussion would lead us to determine the value of $a$.

From the perspective of Frame $S$, the length of Frame $S'$ has contracted from $x'$ to $x'/a$.

Similarly, from the perspective of Frame $S'$, the length of Frame $S$ has contracted from $x$ to $x/a$.

When a Light pulse starts from the spatial point where the Light Source marker $O$ and the Light Source marker $O'$ coincides and the instant of time is counted as $0$ in both frames $S$ and $S'$, the Light pulse would be deducted by both $D$ and $D'$ at a moment when $D$ and $D'$ coincide at a point in Space.

We shall see firstly the scenario of the event of detection of Light from the perspective of the stationary observers of Frame $S$, and then the scenario of the same event from the perspective of the stationary observers of Frame $S'$.
From the perspective of Frame $S$

From the above scenario of the event of detection of Light from the perspective of the stationary observers of Frame $S$,  

$x - x'/a = vt$

This means $x' = a (x - vt) \quad (1)$

$x = ct$

Therefore $x' = a (x - vx/c)$

$x' = a (1 - v/c) x \quad (1a)$

$t' = x'/c = [a (x - vt)] /c = [a (x/c - vt/c)] = [a (t - vt/c)]$

$t' = a (1 - v/c) t \quad (2a)$

Since $t = x/c$, Equation 2(a) may be rewritten as
\[ t' = a \left( t - \frac{vt}{c} \right) = a \left[ t - \frac{v(x/c)}{c} \right] \]

\[ t' = a \left( t - \frac{vx}{c^2} \right) \quad (2) \]

Equations (1) and (2) constitute Lorentz Transformation.

We shall evaluate the value of the factor \( a \) after comparing this scenario from the perspective of Frame \( S \) with the scenario of the same event from the standpoint of Frame \( S' \).

**From the perspective of Frame \( S' \)**

From the above scenario of the event of detection of Light from the perspective of the stationary observers of Frame \( S' \),

\[ \frac{x}{a} - x' = vt' \]
This means $x = a \ (x' + vt') \quad (3)$

\[ x' = ct' \]

Therefore $x = a \ (x' + vx'/c)$

\[ x = a \ (1 + v/c) \ x' \quad (3a) \]

\[ t = x/c = [a \ (x' + vt')] /c = [a \ (x'/c + vt'/c)] = [a \ (t' + vt'/c)] \]

\[ t = a \ (1 + v/c) \ t' \quad (4a) \]

Since $t' = x'/c$, Equation 2(a) may be rewritten as

\[ t = a \ (t' + vt'/c) = a \ [t' + v(x'/c)/c] \]

\[ t = a \ (t' + vx'/c^2) \quad (4) \]

Equations (3) and (4) constitute Inverse Lorentz Transformation.

**Evaluation of the Lorentz Factor $a$**

Equations (1a) and (3a) are, -

\[ x' = a \ (1 – v/c) \ x \quad (1a) \]

\[ x = a \ (1 + v/c) \ x' \quad (3a) \]

The above two Equations represent the same reality - each from the respective perspective of one of the two different inertial frames. For the above two Equations to be identical, -

\[ x' = a \ (1 – v/c) \ a \ (1 + v/c) \ x' \]

This means, -

\[ a = \frac{1}{\sqrt{1 – \frac{v^2}{c^2}}} \]
Equations (2a) and (4a) are, -

\[ t' = a (1 - \frac{v}{c}) t \]  \hspace{1cm} (2a)

\[ t = a (1 + \frac{v}{c}) t' \]  \hspace{1cm} (4a)

The above two Equations represent the same reality - each from the respective perspective of one of the two different inertial frames. For the above two Equations to be identical, -

\[ t' = a (1 - \frac{v}{c}) a (1 + \frac{v}{c}) t' \]

This means, -

\[ a = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \]

### 2.2 Flaws in Lorentz Transformation

**Flaw 1: Lorentz Transformation is based on an implied and ill-conceived premise.**

The **Observed Event** invariably chosen in any method of derivation of Lorentz Transformation in Special Relativity is an event of the detection of the same Light signal by the Light Detector \( D \) in Frame \( S \) and \( D' \) in Frame \( S' \) at the instant when the Light Detectors \( D \) and \( D' \) occupy the same point in Space. In the preceding Section of this paper, we have seen that any event of detection of a Light signal cannot be one single event observable by the stationary observers in Frame \( S \) and those in the frame \( S' \). Therefore, Lorentz Transformation is based on the wrong premise. Since the detection of Light by an inertial reference frame is an event that is exclusive to that Frame, there is no
necessity for any Transformation to know the coordinates of that event in another inertial frame.

**Flaw 2: Lorentz Transformation' ambit is very much limited.**

In our derivation of Lorentz Transformation Equations (vide supra), the observed event was detecting a Light Signal at a spatial point lying on the X-Axis, which passed through the common Origin of the two Frames. We may verify from those Equations that the following relation is satisfied identically.

\[ x'^2 + y'^2 + z'^2 - c^2t'^2 = x^2 + y^2 + z^2 - ct^2 \]

Any incautious consideration of the above Identity has the potential of leading to an erroneous conclusion that Lorentz Transformation Equations apply to the detection of Light Signal at a spatial point anywhere in the Three-dimensional Space. The following discussion would prove that Lorentz Transformation does NOT apply to any event of detection of Light at a spatial point that does not fall on the **X-Axis**, that is, the straight line through the common Origin along the direction of the relative velocity between the Frames.

The following Picture gives an 'assumed' scenario (from the perspective of a stationary observer in the Frame **S**) of an event of detection of Light at a spatial point in the **X-Y Plane** that does **Not** lie on the **X-Axis**.
The Observed Event from the viewpoint of the stationary observers in Frame S

Let us assume that the following Lorentz Transformation Equations apply to the above event of detection of Light from the perspective of the stationary observers of Frame S.

\[ x' = a (x - vt) \] \hspace{1cm} (1)

\[ t' = a (t - vx/c^2) \] \hspace{1cm} (2)

Since \( x = ct \cos\theta \) and \( x' = ct \cos \phi \)

Equation (1) can be written as

\[ x' = a (x - vx/c \cos\theta) \]

\[ x' = a (1 - v/c \cos\theta) x \] \hspace{1cm} (1b)

Equation (2) can be written as
\[ t' = a (t - v c t \cos \theta /c^2) \]  \hspace{1cm} (2)

\[ t' = a (1 - v \cos \theta /c) \, t \]  \hspace{1cm} (2b)

**The Observed Event from the viewpoint of the stationary observers in S'**

Let us assume that the following Lorentz Transformation Equations apply to the above event of detection of Light from the perspective of the stationary observers of Frame \( S' \),

\[ x = a (x' + vt') \]  \hspace{1cm} (3)

\[ t = a (t' + vx'/c^2) \]  \hspace{1cm} (4)

Since \( x = ct \cos \theta \) and \( x' = ct \cos \Phi \)

Equation (3) can be written as

\[ x = a (x' + v x'/c \cos \Phi) \]
\[ x = a \left( 1 + \frac{v}{c} \cos \Phi \right) x' \]  \hspace{2cm} (3b)

Equation (4) can be written as

\[ t = a \left( t' + \frac{v}{c} t' \cos \Phi \right) /c^2 \]

\[ t = a \left( 1 + \frac{v}{c} \cos \Phi \right) t' \]  \hspace{2cm} (4b)

**Evaluation of the Lorentz Factor \( a \)**

Equations (1b) and (3b) are, -

\[ x' = a \left( 1 - \frac{v}{c} \cos \Theta \right) x \]  \hspace{2cm} (1b)

\[ x = a \left( 1 + \frac{v}{c} \cos \Phi \right) x' \]  \hspace{2cm} (3b)

The above two Equations represent the same reality - each from the respective perspective of one of the two different inertial frames. For the above two Equations to be identical, -

\[ x' = a \left( 1 - \frac{v}{c} \cos \Theta \right) a \left( 1 + \frac{v}{c} \cos \Phi \right) x' \]

This means, -

\[ a = \frac{1}{\sqrt{\left(1 - \frac{v}{c} \cos \Theta \right) \left(1 + \frac{v}{c} \cos \Phi \right)}} \]

The factor \( a \) in the above equation would be equal to Lorentz factor \( \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \) only when \( \Theta = 0^\circ \) so that \( \cos \Theta = 1 \), \( \Phi = 0 \) and \( \cos \Phi = 1 \).

The above restriction for the value of \( \Theta \) means that Lorentz Transformation's ambit is confined to the events of detection of Light on the spatial points lying on the X-Axis in Pictures S and S'.
Therefore, Lorentz Transformation fails in respect of the events of detection of
Light at the spatial points **NOT** lying on the **X-Axis**, that is, the straight line
through the common Origin along the direction of the relative velocity between the
Frames.

Equations (2b) and (4b) are, -

\[ t' = a \left(1 - \frac{vc \cos \theta}{c}\right) t \quad \text{(2b)} \]

\[ t = a \left(1 + \frac{v \cos \Phi}{c}\right) t' \quad \text{(4b)} \]

The above two Equations represent the same reality - each from the respective
perspective of one of the two different inertial frames. For the above two Equations to be
identical, -

\[ t' = a \left(1 - \frac{vc \cos \theta}{c}\right) a \left(1 + \frac{v \cos \Phi}{c}\right) t' \]

This means, -

\[ a = \frac{1}{\sqrt{\left(1 - \frac{v \cos \theta}{c}\right) \left(1 + \frac{v \cos \Phi}{c}\right)}} \]

The factor \( a \) in the above equation would be equal to Lorentz factor \( \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \) only
when \( \theta = 0^0 \) so that \( \cos \theta = 1, \Phi = 0 \) and \( \cos \Phi = 1. \)

There is another case also when the factor \( a \) in the above equation would be equal to

Lorentz factor \( \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \).

\[ \frac{\sin \theta}{\sin \Phi} = \frac{ct'}{ct} = \frac{t'}{t} \]

When \( x = vt, \cos \theta = \frac{v}{c} \) and \( \sin \theta = \left(\frac{ct'}{ct}\right) = \frac{t'}{t} \) so that \( \sin \Phi = 1, \) that is, \( \Phi = 90^0, \)
\( \cos \Phi = 0 \) and \( \cos \theta = \frac{v}{c} \)
Therefore, 

\[ a = \frac{1}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} \left(1 + \frac{vc(0)}{c}\right) \]

\[ a = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \]

The above is the scenario usually called "Moving Light Clock", and it is used in some textbooks on Special Relativity to explain "Time Dilation". The above is the scenario that actually corresponds to the equation \( x = vt \) in the context of Lorentz Transformation, though the equation is often taken as representing a particle moving with a velocity \( v \) without mentioning anything about the propagation of Light in the frame having that particle as the Light Source.

The above restrictions for the value of \( \theta \) mean that the ambit of Lorentz Transformation is confined to the events of detection of Light on the spatial points lying on the \textbf{X-Axis}
passing through the Origins of the two Frames $S$ and $S'$ (OR) on the straight line perpendicular to the X-Axis passing through the Origin of the moving Frame $S'$.

**Flaw 3: Lorentz Transformation's universalization by its extension to all events, including those not being detections of Light, is unjustified.**

The derivation of Lorentz Transformation, regardless of the method adopted, is confined to the **Observed Event** of detecting a light signal at a particular Point in Space at a specific instant of time. Lorentz Transformation gives the space coordinates and time coordinate of that event as measured by the stationary observers of one Frame in terms of those coordinates measured by the stationary observers in another frame and vice versa. Their applicability to the other events, including those having no connection with the transmission of light signals, has been taken for granted without giving any justification for such universalization in Special Relativity.

When Lorentz Transformation is confined to the events of detection of Light, its Equations can be written in their pure form using the fundamental proposition **when $x = ct, x' = ct'$**.

\[
x' = x\sqrt{\frac{1 - \frac{v}{c}}{1 + \frac{v}{c}}} \quad \text{(I)}
\]

\[
t' = t\sqrt{\frac{1 - \frac{v}{c}}{1 + \frac{v}{c}}} \quad \text{(II)}
\]
A striking feature of the above equations is that there is no Interdependence of Space and Time.

For the sake of universalization of Lorentz Transformation, the above pure forms of its Equations are discarded, and they are presented in the following popular formats.

\[ x' = \frac{(x-vt)}{\sqrt{1-\frac{v^2}{c^2}}} \]

\[ t' = \frac{(t-vx/c^2)}{\sqrt{1-\frac{v^2}{c^2}}} \]

Besides falsely suggesting the interdependence of Space and Time, the above formats conceal the vital fact that the above equations were derived only in the propagation of light. Their application in other contexts needs to be verified.

**PART – III**

**The Concept of Time in Lorentz Transformation**

**3.1 Events happen independently of Space and Time.**

Contrary to a popular miscaption, Lorentz Transformation has not rejected the Absoluteness of Time enunciated by Sir Isaac Newton. In Newton's own words, Time is "absolute, true and mathematical time, of itself, and from its own nature, flows equably without relation to anything external". Lorentz Transformation also adheres to this concept of Time. When there are agreements on the uniform standard unit for the measurement of Time and the starting instant for calibration of Time, each moment will
have a unique time value. Any event may be arbitrarily chosen as the Origin Event, and the Time of happening of the event is the starting point of the Time Scale.

The focus of Lorentz Transformation is on events. Events happen independently of space and Time. The observers of each frame assign a space coordinate and time coordinate to any observed event based on their observation of that event from their perspectives. Time is a continuous chain of instants of Time – continuing forever independent of events happening in the universe. When an event occurs, the observers in different inertial frames would observe it. Each frame assigns a time instant to that event - one among the infinite time instants constituting an ever-growing Time chain. The absoluteness of Time is not affected by either the happening of events or the observers assigning different time instants to the same event.

The Relativity of Simultaneity in Special Relativity does not mean that the simultaneous events for one frame happen simultaneously in other frames also; still, those events get different values only because of the non-synchronization of their clocks. The correct interpretation of Lorentz Transformation is that the events that have simultaneously happened for one frame S have happened at different times for the other frame S'.

3.2 Mutual Length Contraction.

When Jill is shorter than Jack, it means Jack is taller than Jill. But, according to Lorentz Transformation, when two rods of equal length L, say AB and A'B' are in motion with a uniform, linear, relative velocity, say v, for the observer S stationed on the rod AB, the moving rod A'B' would be found to be shorter than his rod by the factor a. Mystically,
for the observer $S'$ stationed on the rod $A'B'$ also, the moving rod $AB$ would be found to be shorter than his rod by the same factor $a$. Let us see how this seemingly impossible feat happens.

When the ends $A$ and $A'$ coincide, let the observers set the clocks to read $0$. Let us use the notation $(x,t)$ to define an event, where $x$ gives the space coordinate, and $t$ provides the Time with a coordinate. Let us take the coincidence of the ends $A$ and $A'$ as the Origin Event $(0,0)$.

**From the viewpoint of $S$, at the instant when all its clocks show an identical time of 0**

We can see from the above diagram that the length $A'B'$ is measured to be $L/a$ by the observer $S$.

But, the above measurement of the length of $A'B'$ as $L/a$ by $S$ would not be agreeable to $S'$ for the reason that $S$ noted the ruler mark of the end $B'$ at the instant, $-vL/c^2$, and later the ruler mark of the end $A'$ at the instant $0$. According to $S'$, the ruler marks of the two ends of the rod were not simultaneously noted by $S$ at the instant $0$ but with a time gap of
\( -vL/c^2 \) during which the end B would have moved towards the right a distance equal to \( av^2L/c^2 \) and coincided with the ruler mark \( L/a \), i.e., \( (aL - av^2L/c^2) \) of \( S' \). The correct scenario, according to \( S' \) at the instant 0, would be as depicted in the following diagram:

From the viewpoint of the frame \( S' \), at the instant when all its clocks show an identical time of 0

![Diagram of two frames](attachment:diagram.png)

But now, the above measurement of the length of \( AB \) as \( L/a \) by \( S' \) would not be agreeable to \( S \) for the reason that \( S \) noted the ruler mark of the end A at the instant 0, and later the ruler mark of the end B at the instant \( vL/c^2 \). The vicious cycle repeats.

**Discussion**

If every event happens at the same instant of time for all observers, then the physical realities observed by both observers would have been the same, and the mutual accusation of one rod is shorter than the other rod would not have arisen. **Lorentz Transformation unrealistically predicts that whenever an event happens at a particular time for a frame, it has already happened in the past or will happen in the future for any other frame.**
The end $B'$ of the rod $A'B'$ coinciding with the ruler marker $L/a$ of the rod $AB$ really happened because the observers on both frames did not deny the event's happening. They disagree only on when that event occurred. According to the observer in frame $S$, it happened when the Time was $0$. According to the observer in frame $S'$, it happened when the Time was $-vL/c^2$, and at that instant, its end $A'$ was not coinciding with the end $A$ but was at a distance $v^2L/c^2$ from it. This stand of $S'$ is unassailable because it is axiomatic that all clocks of each frame are always synchronized, and it would be unrealistic to say that the clocks at its two ends were showing different times at the instant when the observer in another frame was observing them simultaneously.

The event of the end $B'$ of the rod $A'B'$ coinciding with the ruler marker $L/a$ of the rod $AB$ happening at time $t = 0$ is true for the observer in the Frame $S$. The same event happening $vL/c^2$ seconds earlier is true for the observer $S'$.

**According to Lorentz Transformation, every event in the universe happens at different times for different inertial frames, which implies that the same event recurs infinite times.**

When a specific event is represented by $(X, T)$ in the frame $S$, for that frame, it had happened when the Time was $T$. For any other frame moving with a velocity $v$ relative to it, the same event has occurred at the time $t'$ given by the following expression.

$$t' = \frac{T-vX/c^2}{\sqrt{1-v^2/c^2}}$$
Since the value of $v$ is different for different frames, it varies between $-\infty$ to $+\infty$. So, the event repeats infinite times—one instance for each inertial frame.

The following Graph depicts the Spreading of Simultaneous Events observed in one frame being spread over an infinite time spectrum for another frame.

\[
\tan \theta = -\frac{av}{c^2}
\]
\[
t' = x\tan \theta + at
\]

The simultaneous events happening in the entire universe at an instant of time $t$ relative to an observer in any inertial frame spread over an infinite time spectrum for the observers in all other frames.
PART – IV
Why was Lorentz Transformation untested?

4.1.a Time dilation does not mean slowing down of the moving clocks

On a presupposition that special relativity predicts the “slowing down” of moving clocks, Hafele-Keating Experiment claims to have experimentally confirmed that prediction. Firstly, any Coordinate Transformation proceeds based on an implied premise that the measuring tools used for making measurements are faultless.

The expression \( t' = \frac{t}{a} \) quantifying Time dilation in the theory of special relativity does not indicate any slowing down of a moving clock, but it is only a natural consequence of Length Contraction, which is one of the building blocks of Lorentz Transformation that accounts for the interchangeability of the moving frame and the stationary frame.

When the time difference between the two events is \( t \) relative to the stationary frame \( S \), during this time interval, each clock in the moving frame \( S' \) would cover a distance \( vt \) according to the observers in the frame \( S \). This distance \( vt \) would be equal to \( \frac{vt}{a} \) for the moving frame \( S' \) on account of Length Contraction. Consequently, the time \( t' \) taken by a clock in the frame \( S' \) to cover this distance of \( \frac{vt}{a} \) at the speed \( v \) would be \( \frac{(vt/a)}{v} \), i.e., \( \frac{t}{a} \). Hence, Time dilation is a consequence of more fundamental Length Contraction and not due to any slowing down of the moving clocks. The observed
slowing down of clocks moving with a high-speed relative to the Earth in Hafele–Keating experiment has to be traced to some reason other than Lorentz Transformation. It may be examined whether it is due to the variation of the mass of a body with its velocity. \( m = m_0 / \sqrt{1 - u^2/c^2} \). Nevertheless, we shall proceed to verify whether Hafele–Keating experiment experimentally confirms Lorentz Transformation.

### 4.1.b Hafele-Keating Experiment

Lorentz Transformation is a coordinate transformation giving the space interval and time interval between two events relative to one Frame in terms of those intervals in another frame. Therefore, for any experimental verification of Lorentz Transformation, at least two events separated by non-zero Space and time intervals must be examined. The interchangeability of Frames and their mirroring features are relevant factors in any verification of Lorentz Transformation.

When Lorentz Transformation connects two frames, the frames are interchangeable – one Frame being the 'moving' frame for the other and vice versa. The transformation equation relates the time intervals say \( \Delta t \) and \( \Delta t' \) measured by the two frames \( S \) and \( S' \) with a uniform linear relative velocity \( v \) between them.

From the viewpoint of \( S \),

\[
\Delta t' = a\Delta t - av\Delta x/c^2
\]

From the viewpoint of \( S' \),

\[
\Delta t = a\Delta t' + av\Delta x'/c^2
\]

Where \( \Delta x = \text{Space interval between the events relative to } S \); and

\( \Delta x' = \text{Space interval between the events relative to } S' \); and
\[ a = \sqrt{1 - \frac{v^2}{c^2}} \]

Since the Lorentz Transformation is a coordinate transformation, ideally, it should not alter physical reality. Any experiment intended to validate the Lorentz Transformation should verify whether it correctly transforms from one Frame to another space and time intervals of any two events. Keeping it in mind, let us examine the results obtained in the Hafele–Keating experiment and the subsequent verification of those results by more accurate methods [3]. In those experiments, high-precession clocks carried in aircraft were running slower than the earth clock by a very close factor. We shall proceed on the premise that the results of those experiments are accurate. Let us visualize the following scenario:

Let \( A, B \) and \( C \) be three clocks fixed on the earth so that \( AB = v \) meters and \( BC = v \) meters. Let \( F_1 \) and \( F_2 \) be two aircraft set with clocks flying with uniform linear velocity \( v \) m/s relative to the earth. Let \( F_1 \) be above \( A \) and \( F_2 \) be above \( B \) at an instant of time at which the three clocks \( A, B \) and \( C \) fixed on the earth and the clock fixed with the aircraft \( F_1 \) are set to read zero.
After 1 second, each aircraft would have moved a distance $v$ meter relative to the earth, and the new scenario would be as follows:

Now we can consider four events:

**Event 1:** The Aircraft $F1$ was above point $A$ on the earth.

**Event 2:** The Aircraft $F2$ was above point $B$ on the earth.

**Event 3:** The Aircraft $F1$ was above point $B$ on the earth.

**Event 4:** The Aircraft $F2$ was above point $C$ on the earth.

The following table gives the time intervals between any two of the above four events relative to the aircraft frame as predicted by Lorentz Transformation and the actual time intervals measured in the **Hafele–Keating experiment** and other subsequent similar experiments.
|   | Between Time Interval in the Earth Frame (Seconds) | Time Interval in the Aircraft Frame (Seconds) Predicted by Lorentz Transformation | Measured in the Experiment |
|---|--------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------|
| 1 | **Event 1** and **Event 2**                     | 0                                                                               | -av²/c²                     | 0                           |
| 2. | **Event 2** and **Event 3**                     | 1                                                                               | a                           | 1/a                         |
| 3. | **Event 1** and **Event 3**                     | 1                                                                               | 1/a                         | 1/a                         |
| 4. | **Event 1** and **Event 4**                     | 1                                                                               | 1/a - av²/c²                | 1/a                         |
| 5. | **Event 2** and **Event 4**                     | 1                                                                               | 1/a                         | 1/a                         |
| 6. | **Event 3** and **Event 4**                     | 0                                                                               | -av²/c²                     | 0                           |

It may be seen that out of the above six pairs of events, the predictions of Lorentz Transformation were found to agree with the experimental results only in respect of two pairs of events. Hence, Lorentz Transformation cannot be said to have been experimentally confirmed.


### 4.2 The Mu-Meson Experiment

Let us consider the phenomenon of rapidly falling $\mu$ mesons first from a frame of reference attached to the earth and then from the perspective of a frame of reference attached to a frame of reference that moves with the mesons.

In the following figures, an event is defined as $(x, t)$, where $x$ and $t$ denote the space and time coordinates, respectively.

#### 4.2.1 From the standpoint of a frame of reference attached to the earth

**Initial Scenario**

| Event Definition in Earth Frame | Event Definition in $\mu$ meson Frame |
|--------------------------------|--------------------------------------|
| $(-h, 0)$                      | $(-ah, +avh/c^2)$                    |
| $(0, 0)$                       | $(0, 0)$                             |

![Diagram of initial scenario](image-url)
Final Scenario

| Event Definition in Earth Frame | Event Definition in μ meson Frame |
|--------------------------------|----------------------------------|
| (-h, h/v)                      | (-2ah, avh/c²+ah/v)              |
| (0, h/v)                       | (-ah, ah/v)                      |

Time elapsed in μ mesons frame = ah/v – avh/c² = ah/v (1 – v²/c²)

= h/av

Time elapsed in earth frame = h/v – 0

= h/v

4.2.2 From the stand point of a frame of reference that moves with the mesons

Initial Scenario

| Event Definition in Earth Frame | Event Definition in μ meson Frame |
|--------------------------------|----------------------------------|
| (-h, -vh/c²)                   | (-h/a, 0)                        |
| (0, 0)                         | (0, 0)                           |
Final Scenario

| Event Definition in Earth Frame | Event Definition in μ meson Frame |
|---------------------------------|----------------------------------|
| (0, h/a²v)                      | (-h/a, h/av)                     |

Time elapsed in μ mesons frame = h/av – 0

= h/av

Time elapsed in earth frame = h/a²v – 0

= h/a²v

Since the time elapsed in μ mesons frame is h/av from the viewpoint of both earth frame and μ mesons frame, it has been concluded that the time dilation is a fact of experience. But, in the perspective of μ mesons frame, the time elapsed in the earth frame is h/a²v, which is less than h/av, which is the time elapsed in μ mesons frame. It means that for an observer moving along moving μ mesons, the μ mesons stationary on the earth would be decaying at a slower rate. This reduction of the decay rate of μ mesons stationary on the earth from the perspective of an observer moving along with moving μ mesons has not been experimentally verified. When Time Dilation has been predicted as a mutual phenomenon between the two frames, one-sided verification of the phenomenon cannot be taken as the confirmation of that prediction. Therefore, the reduction in fast-moving μ
mesons' decay rate cannot be attributed to Time Dilation predicted by Lorentz Transformation. The real reason for such reduction has to be traced elsewhere. The possibility of attributing such delayed decay of radioactive substances to the Relativistic variation of Mass with Velocity may be examined.

PART – V
Lorentz Transformation is unnecessary in Special Relativity.

5.1 Mass – Energy equivalence can be derived without Lorentz Transformation.

Suppose the mass of a particle when it is at rest in an inertial frame is \( m_0 \). Let its relativistic mass be \( m \), while it is moving with speed \( u \) relative to that Frame. We know -

\[
 m = \frac{m_0}{\left(1 - \frac{u^2}{c^2}\right)^{1/2}}
\]

Generally, the above equation \([4]\) is derived using Lorentz Transformation Equations. But the above equation can be arrived at without the use of Lorentz Transformation Equations based on the following observed facts, -

1. It has been experimentally proved that no particle can travel faster than \( c \), the Speed of Light. When a particle's speed is accelerated to a value near \( c \), the inertial mass \( m \) that resists acceleration tends to become \( \infty \), thereby making it impossible to make the particle reach Light's speed.
2. The rest mass of any particle is found to be the same in all inertial frames.
   \[ \text{When } u = 0, \ m = m_0 \]

3. The above equation corresponds to the fact that the work done on a particle by an external force becomes the particle's kinetic energy with an approximate value of \( \mu u^2/2 \).

As already said, the observed slowing down of clocks moving with a high-speed relative to the Earth in Hafele–Keating experiment may be due to the variation of the mass of the clock with its velocity.

It has been shown in many textbooks [5] on Special Theory of Relativity that from the above equation giving a variation of mass with velocity, the following famous mass-energy equivalence equation can be derived;

\[ E = mc^2 \]

Thus, Einstein's Special Theory Relativity can stand on its own merits without paradoxical Lorentz Transformation, which unjustifiably rejects Newton's concept of Absoluteness of Time.

6. Conclusions

1. The Constancy of the Speed of Light measured in all frames of references is due to each observer's perceptions that Space is at rest relative to his Frame of Reference, the Light Source is static in his Frame of Reference, the Light originating from that stationary Source spreads as a spherical electromagnetic
wave in all directions with a speed $c$ in his static Space; and the Light so spreading is capable of being detected only by any Light Detector that is stationary in the Frame.

2. The detection of Light by an inertial reference frame is an event that is exclusive to that Frame.

3. Lorentz Transformation is conceptually flawed.

4. Time is absolute. There is no Interdependence of Space and Time.

5. The results obtained in the Hafele–Keating experiment and $\mu$ meson experiment do not support the predictions of the Lorentz Transformation.

6. The Mass – Energy equivalence $E = mc^2$ can be derived without Lorentz Transformation.

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Figures

Figure 1

Structure of the proposed GRATING GRAPHENE MGIM waveguide under consideration

Figure 2

an alternating and non-alternating structure of nano-particles.
r=[];
For i=1:N1
For j=1:N2
For k=1:N3
If B(i,j,k)==1
r=[r [(i-(N1+1)/2)*d;(j-(N2+1)/2)*d;(k (N3+1)/2)*d].'];
End;End;End;End;

Figure 3
Nanoparticle positioning algorithm

Figure 4
nanoparticles with different values of a, b, c
Figure 5

Comparison of SHG for periodic and nonperiodic structures

Figure 6

the optical power of SHG for proposed structure with optimized nanoparticles
Figure 7

The optical power of the SHF peak and the position of the SHG process peak relative to the grating distance.
Figure 8

SHF peak optical power and position of the SHG peak relative to the duty cycle
Figure 9

The optical power of the SHF peak and the position of the SHG peak relative to the grating depth.