Relativistic Variables: length, Time, Simultaneity, Mass, Energy and Momentum in Inverse Relativity

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ABSTRACT

When changing the observation conditions used in special relativity, we get a new model called inverse relativity, we mentioned this in the second paper and third paper, where we find the relativistic variables in the classic observation conditions or in the special relativity becomes inverse variables in the new observation conditions, such as the length in the direction of motion in the new observation conditions remains constant instead of contraction, this means that the contraction of length expands until it reaches its original value, the time also contracts until it becomes super time instead of dilating with increasing the speed of the reference frame, the simultaneity between two events separated by a distance relative to an observer in the new observation conditions, the two events remain simultaneous relative to the other observer instead of non-simultaneity, the mass and energy in the new observation conditions are decreasing rather than increasing with the speed of the reference frame, the relativistic momentum in the new observation conditions remains constant, this means that the increase in relativistic momentum decreases until it reaches its original value, We conclude from all this that the relativistic variables in special relativity appear inverted in the new model, This is why the model is called the inverse theory of relativity

Keywords: inverse time relativity, inverse mass relativity, super time, modified Lorentz transformations, Minkowski space splitting, negative space, inverse relativity, energy-time paradox

1 INTRODUCTION

In classical mechanics, specifically in Galilean relativity, we find that physical quantities such as length, time, the simultaneity between two events and mass are physical constants when converting from one inertial reference frame to another, but the special theory of relativity changed our understanding of physical constants, where these constants appeared as relativistic variables in converting from one inertial reference frame to another, when the relative velocity between the reference frames is close to the speed of light, For example, The length contracts in the direction of motion of the reference frame, and the time dilation with the motion of the reference frame, as well as simultaneous events relative to one observer are not necessarily simultaneous relative to the other observer, as for the mass, it increases with the motion of the reference frame, in the second paper (Modified Lorentz transformations and Minkowski space Splits in Inverse Relativity) [1] and the third paper (Positive and Negative Energy in Inverse Relativity) [2] we obtained a new model known as Inverse Relativity that is achieved through a new observation condition, will it the relativistic variables Such as length in the direction of motion, time, simultaneity, mass, energy and momentum remain the same with the new observation conditions? Or will the new model reveal to us another behavior of these variables? If there is a different behavior for these relativistic variables, does it have a specific pattern?, The answers to these questions depend on the description of those relativistic variables in the new observation conditions on which the new model is based, which was previously mentioned in the second and third papers.

2 METHODS

2-1 Inverse length Relativity

We assume that we have two reference frames S and S' from orthogonal Cartesian coordinate systems [9] [3], each reference frame has an observer at the origin O and O', and that the frame S' is moving at a uniform velocity V_S relative to the S frame in the positive direction of the X-axis, We also assume that we have in the reference frame S' a fixed rod in a position parallel to both the X-axis and the X'-axis, so that the length of the rod is in the direction of motion of the reference frame S', look at Figure: 1-4

$S` \rightarrow\ x`\ y`\ z`\ t`$

$S \rightarrow\ x\ \ y\ \ z\ \ t$

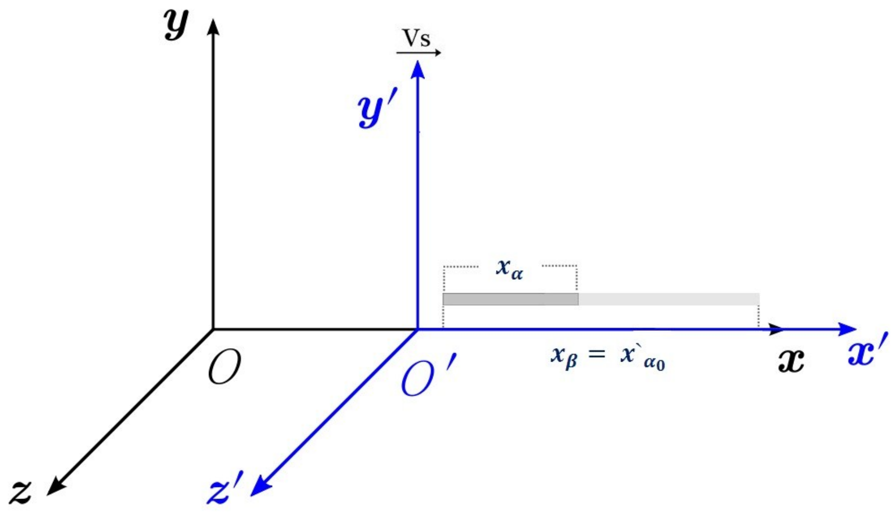

Figure: 1-4

Because the rod is parallel to the X'-axis, so the two ends of the rod represent two points along the X'-axis, and the length of the rod is the difference between these two points $l\grave{}_{\alpha_0} = \Delta x\grave{}_{\alpha_0}$, where $l\grave{}_{\alpha_0}$ is the length of the rod that observed by the observer O' relative to the reference frame S' (vector symbol $\overrightarrow{\alpha\grave{}_0}$ here to express the first observation conditions), because the rod is parallel to the X-axis as well, and therefore the length of the rod is equal to the difference between the two points along the X-axis, i.e. equal to $l_\alpha = \Delta x_\alpha$, where l_α is the length of the rod in the direction of motion observed by the observer O relative to the reference frame S (vector symbol $\overrightarrow{\alpha}$ here also to express the first observation conditions), To convert the length of the rod from the frame of reference S' to the frame of reference S in the first observation conditions, we use here the first equation from the Lorentz transformations [7] With the vector symbol used in the second paper

$$x\grave{}_{\alpha_0} = \gamma\,(\,x_\alpha - V_s\,t_\alpha\,) \tag{6.2}$$

Where γ Lorentz factor

$$\gamma = \frac{1}{\sqrt{1 - \frac{V_S^2}{c^2}}} \tag{5.2}$$

The last equation represents the transformation of a point from the X-axis to the X'-axis, and thus the transformation of a period or distance between two points [5] is as follows

$$\Delta x`_{\alpha_0} = \gamma \, (\, \Delta x_\alpha - V_s \, \Delta t_\alpha \,) \tag{1.4}$$

Because the measurement of the two points is at the same moment, therefore each of $\Delta t`_{\alpha_0} = 0$ and $\Delta t_\alpha = 0$, by substituting for that in the previous equation, we get

$$\Delta x`_{\alpha_0} = \Delta x_\alpha \; \gamma \tag{2.4}$$

Substitute the value of each side into the equation, where each side represents the length of the rod, and rearrange the equation

$$l_\alpha = \grave{l}_{\alpha_0} \; \gamma^{-1} \tag{3.4}$$

Equation 3.4 shows us that the length of the rod l_α decreases with the increase in the speed of the reference frame V_S, that is, the length in the direction of motion decreases in the first observation conditions or according to special relativity [4] [5] [6], but if we want to observe the length of the rod in the second observation conditions (It is a purely theoretical observation process, as mentioned earlier in the second paper), We find the length of the rod l_β in the second observation conditions equal to $l_\beta = \Delta x_\beta$ according to the principle of inverse relativity (which is the commitment to the principle of special relativity [3] in the second observation conditions), To convert the length of the rod from the frame of reference S' to the frame of reference S in the second observation conditions, we use here the first equation from the modified inverse Lorentz transformation in the second paper

$$x_\beta = x`_{\alpha_0} \tag{26.2}$$

The last equation represents the transformation of a point from the X'- axis to the X-axis in the second observation conditions, and thus the transformation of a period or distance between two points is as follows

$$\Delta x_\beta = \Delta x`_{\alpha_0} \tag{4.4}$$

Substitute the value of each side into the equation, where each side represents the length of the rod

$$l_\beta = \grave{l}_{\alpha_0} \tag{5.4}$$

Equation 4.5 shows us that the relativistic length in the direction of motion in the second observation conditions is constant and does not change, this means that the length contraction in the first observation conditions expands when moving to the second observation conditions until it reaches the original value, So we call the relativity of length in the second observation conditions the inverse relativity of length, The length in the second observation conditions is also called the positive length, It has the properties of positive space mentioned in the second paper, where we find here the length symmetrical relative to all observers, like spatial symmetry in positive space relative to all.

2-2 Inverse Simultaneity Relativity

We have already mentioned in the second paper the time conversion from the frame of reference S' to the frame of reference S in the second observation conditions, i.e. from vector $\overrightarrow{\alpha`_0}$ to vector $\overrightarrow{\beta}$ or time in positive space, Therefore, we will describe here the relativity of simultaneity [12] between two events in the second observation conditions or in the positive space, where we assume the occurrence of two events separated by a distance of $\Delta x`_{\alpha_0}$ (for example, two lightning bolts in the sky) observed by the observer O' relative to the reference frame S' and assuming the moment of the occurrence of the two events, each of $x_0 = x`_0 = 0$ and $t_0 = t`_0 = 0$, We must first describe the two events according to special relativity, where we get the time transformation of each event in the first observation conditions through Equation 9.2 of the inverse Lorentz transformations [7] [3] With the vector symbol used in the second paper

$$t_\alpha = \gamma\left(t`_{\alpha_0} + \frac{V_s\, x`_{\alpha_0}}{c^2}\right) \qquad (9.2)$$

As for the transformation of a time period between the two events [6], it is as follows

$$\Delta t_\alpha = \gamma\left(\Delta t`_{\alpha_0} + \frac{V_s\, \Delta x`_{\alpha_0}}{c^2}\right) \qquad (6.4)$$

In the case if the two events are simultaneous relative to the observer O', then $\Delta t`_{\alpha_0} = 0$, by substituting for that in the previous equation

$$\Delta t`_{\alpha_0} = \; 0 \qquad\qquad \Delta t_\alpha \neq 0 \tag{7.4}$$

This means that the two events that are simultaneous relative to the observer O' are not simultaneous relative to the observer O, i.e. the simultaneity in the first observation conditions or on the Minkowski diagram [6] [12] is relativistic, but if we want to observe the simultaneity between the same two events, but in the second observation conditions, i.e. in the positive space, we use equation 29.2 from the modified inverse Lorentz transformations to convert the time of each event in the second observation conditions.

$$t_\beta = \; t`_{\alpha_0} \; \gamma \tag{29.2}$$

So, converting the time period between the two events is

$$\Delta t_\beta \; = \; \Delta t`_{\alpha_0} \; \gamma \tag{8.4}$$

Because the two events are simultaneous, as we have previously assumed above, then we substitute $\Delta t`_{\alpha_0} = 0$ in the previous equation

$$\Delta t`_{\alpha_0} = \; 0 \qquad\qquad \Delta t_\beta = 0 \tag{9.4}$$

This means that the two events also remain simultaneous in the second observation conditions or in the positive space, which is the opposite result of the previous result in the first observation conditions as shown in equation 4.7, so we call the relativity of simultaneity here the inverse simultaneity relativity.

2-3 Inverse Time Relativity

But if we want here to describe the time of any of the previous two events in negative space to be the motion of a light pulse resulting from one of the two lightning bolts in the negative direction of the $x`_{\alpha_0}$ axis observed by the observer O' relative to the frame of reference S', To represent this event in negative space we use equations 46.2 and 49.2 from the inverse transformations of vector $\overrightarrow{\varphi}$ in the second paper

$$x_\varphi \; = \; \gamma \left(V_s t`_{\alpha_0} + x`_{\alpha_0}(1 - \gamma^{-1}) \; \right) \tag{46.2}$$

$$t_\varphi \; = \gamma \left(t`_{\alpha_0} \; + \frac{V_s \, x`_{\alpha_0}}{c^2} \right) \tag{49.2}$$

Equation 49.2 expresses the negative time of the event at any value of $x`_{\alpha_0}$ What the negative time means here is not the reverse time (time back to the past), but time does not express causality, negative space time and negative energy, or the time parallel to the observer's space O', but if we want here to study the negative time of the event at the level of symmetrical distances between the observer's space O' and the negative space, that is, when $x_\varphi = -x`_{\alpha_0}$ by substituting for that in equation 46.2

$$-x`_{\alpha_0}\gamma^{-1} = V_s t`_{\alpha_0} + x`_{\alpha_0}(1-\gamma^{-1}) \quad (10.4)$$

$$-x`_{\alpha_0}\gamma^{-1} = V_s t`_{\alpha_0} + x`_{\alpha_0} - x`_{\alpha_0}\gamma^{-1} \quad (11.4)$$

$$x`_{\alpha_0} = -V_s t`_{\alpha_0} \quad (12.4)$$

Substitute from 12.4 into 49.2

$$t_\varphi = \gamma\left(t`_{\alpha_0} - \frac{V_s V_s\, t`_{\alpha_0}}{c^2}\right) \quad (13.4)$$

Taking $t`_{\alpha_0}$ as a common factor

$$t_\varphi = t`_{\alpha_0}\gamma\left(1 - \frac{V_S^2}{c^2}\right) \quad (14.4)$$

Substitute from 5.2 into 14.4

$$t_\varphi = t`_{\alpha_0}\gamma\ \ \gamma^{-2} \quad (15.4)$$

$$t_\varphi = t`_{\alpha_0}\ \ \gamma^{-1} \quad (16.4)$$

We get Equation 16.4, which is a special case of negative time in which we have assumed a value of $x`_{\alpha_0}$ equal to the value $-x_\varphi$ in other words, when the distances are symmetric in negative space transformations, this equation shows us that the time t_φ decreases on the vector $\overrightarrow{\varphi}$ relative to the observer O with the increase in the speed of the reference frame V_S, Which is the opposite result of time dilation [4] [5] [6] on the vector $\overrightarrow{\alpha}$ or equation 9.2, Therefore, the time relativity here is called the inverse relativity of time, if the frame of reference S' is moving at speeds less than the speed of light, the amount of time contraction is very small and can be neglected, but when the frame of reference S' moves at speeds close to the speed of light, the amount of contraction in time is very large and we call it super time, and when the speed of the reference frame reaches the speed of light theoretically, it contracts on the vector $\overrightarrow{\varphi}$ to infinity or the value of time becomes zero.

2-4 Inverse Mass Relativity

In the third paper equation 24.3, we obtained the conversion of mass from the frame of reference S' to the frame of reference S in the first observation conditions or according to special relativity [8] [10] i.e. from vector $\overrightarrow{\grave{\alpha}_0}$ to vector $\overrightarrow{\alpha}$, but if we want to obtain the conversion of mass from the frame of reference S' the frame of reference S in the second observation conditions, i.e. from vector $\overrightarrow{\grave{\alpha}_0}$ to vector $\overrightarrow{\beta}$ we use Equation 48.3 to convert the relativistic kinetic energy in the second observation conditions from the third paper

$$m_\alpha = \grave{m}_{\alpha_0}\ \gamma \tag{24.3}$$

$$KE_\beta = \grave{KE}_{\alpha_0}\ \gamma^{-1} \tag{48.3}$$

According to special relativity, the relativistic kinetic energy is equal to the change in relativistic mass, meaning that $\grave{KE}_{\alpha_0} = \Delta \grave{m}_{\alpha_0}$ [4] [8], and according to the principle of inverse relativity (which is a commitment to the principle of special relativity In the second observation conditions), the relativistic kinetic energy on the vector $\overrightarrow{\beta}$ is also equal to $KE_\beta = \Delta m_\beta$, by substituting the value of each side into equation 48.3

$$\Delta m_\beta = \Delta \grave{m}_{\alpha_0}\ \gamma^{-1} \tag{17.4}$$

And from it, we get

$$m_\beta = \grave{m}_{\alpha_0}\ \gamma^{-1} \tag{18.4}$$

Equation 18.4 shows that the relativistic mass of the particle m_β in the second observation conditions decreases with the increase in speed of the reference frame V_S, which is the opposite result of the mass conversion in the first observation conditions or according to the special relativity in equation 24.3, So we call the relativity of mass here inverse mass relativity, and it is also called m_β with positive mass, and it acquires all the features of positive kinetic energy and the properties of positive space that were previously mentioned in the second and third papers.

As we get a positive mass, we also get a negative mass, which is the mass on the vector $\overrightarrow{\varphi}$, and according to the law of conservation of matter, it is equal to the difference between the mass equivalent of energy [9] [11] on the net vector $\overrightarrow{\alpha}$ and the equivalent mass of energy on the vector $\overrightarrow{\beta}$

$$m_\varphi = m_\alpha - m_\beta \tag{19.4}$$

Substitute from 18.4, 24.3 into 19.4

$$m_\varphi = m\grave{}_{\alpha_0}\,\gamma - m\grave{}_{\alpha_0}\,\gamma^{-1} \tag{20.4}$$

$$m_\varphi = m\grave{}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{21.4}$$

As we mentioned in the second paper, the vector $\overrightarrow{\varphi}$ is the vector of negative space, so we put a negative sign in the previous equation

$$m_\varphi = -\, m\grave{}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{22.4}$$

Equation 22.4 shows that the negative mass m_φ increases with the increase in velocity V_S, and it also acquires all the features of negative kinetic energy and the properties of negative space previously mentioned in the second and third papers, Equations 18.4 and 22.4 do not represent an analysis of mass on the vector $\overrightarrow{\alpha}$, but rather the result of analyzing the equivalent energy of mass over the vector $\overrightarrow{\alpha}$.

2-5 Inverse Relativistic Energy

We can also obtain the conversion of the total energy of a particle with a real rest mass [4] [12] from the frame of reference S' to the frame of reference S in the first observation conditions i.e. from vector $\overrightarrow{\alpha\grave{}_0}$ to vector $\overrightarrow{\alpha}$, by multiplying both sides of the equation 24.3 by c^2

$$m_\alpha c^2 = m\grave{}_{\alpha_0}\, c^2\, \gamma \tag{23.4}$$

Where the amount $m_{\grave{\alpha}_0}c^2$ represents the relativistic total energy of the particle on the vector $\overrightarrow{\grave{\alpha}_0}$ or the dimensional rest mass energy as we mentioned in the third paper, while the amount $m_\alpha c^2$ represents the relativistic total energy on the vector $\overrightarrow{\alpha}$, Substituting the value of each side into equation 23.4, we get the same equation 6.3 in the third paper that applies to the massless particle (Photon)

$$E_\alpha = E_{\grave{\alpha}_0} \gamma \tag{6.3}$$

As for converting the relativistic total energy of a particle with a real rest mass from the frame of reference S' to the frame of reference S in the second observation conditions, i.e. from vector $\overrightarrow{\grave{\alpha}_0}$ to vector $\overrightarrow{\beta}$, we multiply both sides of equation 18.4 by c^2

$$m_\beta c^2 = m_{\grave{\alpha}_0}c^2 \gamma^{-1} \tag{24.4}$$

If the relativistic total energy [4] of the particle on the vector $\overrightarrow{\grave{\alpha}_0}$ is equal to $E_{\grave{\alpha}_0} = m_{\grave{\alpha}_0}c^2$, then the relativistic total energy on the vector $\overrightarrow{\beta}$ according to the principle inverse relativity is equal to $E_\beta = m_\beta c^2$, by substituting the value of each side into equation 24.4, we get the same equation 11.3 in the third paper that applies to the massless particle (Photon)

$$E_\beta = E_{\grave{\alpha}_0} \gamma^{-1} \tag{11.3}$$

Equation 11.3 shows that the relativistic total energy E_β of a particle with a real rest mass in the second observation conditions decreases with the increase in the speed of the reference frame V_S, which is the opposite result of the conversion of the relativistic total energy in the first observation conditions or according to special relativity shown in equation 6.3, so we call the relativistic energy here the inverse relativistic energy, also called E_β the positive total energy, and it acquires all the features of positive kinetic energy and the properties of positive space that were previously mentioned in the second and third papers.

To get the total negative energy or the total energy on the vector $\overrightarrow{\varphi}$ for a particle with a real rest mass, we use the law of conservation of energy and follow the same previous steps in equations from 20.4 to 23.4, we get the same equation 16.3 in the third paper that applies on the massless particle (Photon)

$$E_{\varphi} = -E`_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \quad (16.3)$$

Equation 16.3 shows that the negative mass E_{φ} increases with the increase in speed V_S, and it also acquires all the features of negative kinetic energy and the properties of negative space previously mentioned in the second and third paper, we can understand the symmetry between the total energy transformation equations for a massless particle and a real rest mass particle through the dimensional rest mass hypothesis, where we assumed that the photon as a wave [15] is stuck in one dimension of spatial space is a particle that has a dimensional rest mass and does work on it, we can also assume that the particle with real rest mass is an energy wave stuck in one of the dimensions of space, In other words, the wave phenomenon can be viewed on the dimension of rest as a mechanical phenomenon, and the mechanical phenomenon can be viewed at the dimension of motion as a wave phenomenon

2-6 Inverse Relativistic Momentum

We use the example mentioned in the third paper, a particle with a real rest mass and moving with relativistic velocity on the vector $\overrightarrow{\alpha`_0}$ relative to the frame of reference S', Therefore, the particle has a relativistic momentum relative to the frame of reference S', the momentum here also depends on the particle's velocity on the vector $\overrightarrow{\alpha`_0}$,Not on the velocity of the reference frame S' so we assume an imaginary reference frame that moves on the vector $\overrightarrow{\alpha`_0}$ and with the speed $V`_{\alpha_0}$ as we assumed previously in the third paper, and we write the equation of relativistic momentum from frame S' to the imaginary frame according to relativity Special [6] [7] in the following form

$$\vec{p}`_{\alpha_0} = m`_{\alpha_0}\vec{V}`_{\alpha_0} \qquad \vec{V}`_{\alpha_0} < c \quad (25.4)$$

Where $\vec{p}`_{\alpha_0}$ is the relativistic momentum of the particle on the vector $\overrightarrow{\alpha`_0}$, which is observed by the observer O' relative to the frame of reference S', i.e. in the first observation conditions, $V`_{\alpha_0}$ is the relativistic velocity of the particle (or imaginary frame velocity) relative to the reference frame S', and $m`_{\alpha_0}$ the relativistic mass of the particle on the same vector, the last equation describes the relativistic momentum of the particle relative to the frame of reference S' in the relativistic formula, when the particle's velocity is close to the speed of light, but the velocity of the particle can be much less than the speed of light, as we mentioned earlier, it does not depend on the speed of the reference frame S', in this case the relativistic formula goes back to the classical formula of momentum

$$\overrightarrow{p}\grave{}_{\alpha_0} = \grave{m}_0 \vec{V}\grave{}_{\alpha_0} \qquad \qquad \vec{V}\grave{}_{\alpha_0} \ll c \tag{26.4}$$

In a similar way, we can describe the relativistic momentum of the particle on the vector $\overrightarrow{\alpha}$ relative to the reference frame S, i.e. in the first observation conditions as well [12]

$$\overrightarrow{p}_{\alpha} = m_{\alpha} \vec{V}_{\alpha} \tag{27.4}$$

where $\overrightarrow{p}_{\alpha}$ the relativistic momentum of the particle on the vector $\overrightarrow{\alpha}$, which is observed by the observer O relative to the frame of reference S, i.e. in the first observation conditions, $\overrightarrow{V_{\alpha}}$ is the resultant velocity of the particle relative to the frame of reference S and it increases with the increase in the speed of the reference frame according to the second paper, as for m_{α} it is the relativistic mass of the particle on the same vector, and it also increases with the increase in the speed of the reference frame according to equation 24.3, Thus, we conclude that the relativistic momentum in the first conditions of observation increases with the increase in the speed of the reference frame, because the relativistic momentum includes the velocity factor as well as the mass factor, so we can analyze the relativistic momentum here, where the velocity vector $\overrightarrow{V_{\alpha}}$ is analyzed into two components $\overrightarrow{V_{\beta}}$ and $\vec{V}_{\varphi}$, but the mass m_{α} is a scalar quantity that cannot be analyzed, we mentioned this in the third paper

Thus, the relativistic momentum of the particle on the vector $\overrightarrow{\beta}$ is written by the following formula

$$\overrightarrow{p}_{\beta} = m_{\alpha} \vec{V}_{\beta} \tag{28.4}$$

Where $\overrightarrow{p}_{\beta}$ the relativistic momentum of the particle on the vector $\overrightarrow{\beta}$ which is observed by the observer O relative to the frame of reference S' in the second observation conditions, $\overrightarrow{V_{\beta}}$ the velocity of the particle on the vector $\overrightarrow{\beta}$, We know from the second paper, equation 58.2, that the velocity $\overrightarrow{V_{\beta}}$ decreases with the increase in the speed of the reference frame and from equation 24.3 the mass m_{α} increases with the increase in the speed of the reference frame V_S, Thus, we cannot directly know here whether the relativistic momentum in the second observation conditions increases or decreases so we must obtain the transformation of momentum from the vector $\overrightarrow{\alpha`_0}$ to $\overrightarrow{\beta}$, this is by converting each of the mass m_α and the velocity $\overrightarrow{V_\beta}$ mentioned in the second and third papers

$$\vec{V}_\beta = \vec{V}^{`}_{\alpha_0}\ \gamma^{-1} \tag{58.2}$$

Substitute from 24.3, 58.2 into 28.4

$$\vec{p}_\beta = m^{`}_{\alpha_0}\ \gamma\ \vec{V}^{`}_{\alpha_0}\ \gamma^{-1} \tag{29.4}$$

$$\vec{p}_\beta = m^{`}_{\alpha_0}\ \vec{V}^{`}_{\alpha_0} \tag{30.4}$$

Substitute from 25.4 into 30.4

$$\vec{p}_\beta = \vec{p}^{`}_{\alpha_0} \tag{31.4}$$

Equation 31.4 shows us that the relativistic momentum in the second observation conditions is constant and does not change, in other words, momentum is a conserved quantity and this means that the momentum increase in the first observation conditions decreases when moving to the second observation conditions until it reaches the original value, Therefore, we call the relativistic momentum in the second observation conditions the inverse relativistic momentum, and it is also called the positive relativistic momentum and also has all the features of positive energy and the properties of positive space mentioned in the second and third papers, the result of the positive momentum transformation agrees with Emmy Noether's theorem [7] [13] because positive space is spatially symmetric (see modified Lorentz transformations in the second paper)

The relativistic momentum of the particle on the vector $\overrightarrow{\varphi}$ is written in the following form

$$\vec{p}_\varphi = m_\alpha\ \vec{V}_\varphi \tag{32.4}$$

Where $\vec{p}_\varphi$ the relativistic momentum of the particle on the vector $\overrightarrow{\varphi}$, $\vec{V}_\varphi$ is the particle's velocity on the vector $\overrightarrow{\varphi`}$, and because both m_α, $\vec{V}_\varphi$ increase with the increase in the speed of the reference frame according to the second and third papers, therefore, the relativistic momentum on the vector $\overrightarrow{\varphi}$ increases with the increase in the speed of the reference frame, and it is called negative relativistic momentum and has all the features of negative energy and the properties of negative space also mentioned in the second and third papers

3 RESULTS

The model of the special theory of relativity depends on the study of relativistic variables (length - time - simultaneity - mass - energy - momentum) on the four-dimensional vector resulting from the Lorentz transformation, which is achieved through specific observation conditions, while the new model depends on analyzing this vector into two vectors, where one of them expresses new observation conditions, and when studying the same variables through the two vectors, we find that the variables have an inverse pattern of change, where we find the length in the direction of motion of the reference frame remains constant in the new observation conditions instead of contraction, This means that the contraction in length expands until it reaches its original value when moving from the first to the second conditions, the simultaneity between two events separated by a distance relative to an observer in the second observation conditions, the two events remain simultaneous relative to the other observer instead of non-simultaneity in the first observation conditions, the negative or parallel time contracts (at the level of symmetric distances in negative space transformations) until it becomes super time instead of dilating in the first observation conditions with the motion of the reference frame, We also find mass and energy in the second observation conditions decreasing instead of the increase with the motion of the reference frame in the first observation conditions, As for the relativistic momentum in the second observation conditions, it remains constant or conserved, rather than the increase as in the first observation conditions, this means that the increase in relativistic momentum decreases until it reaches its original value when moving from the first conditions to the second, we conclude from this that the relativistic variables in special relativity appear inversely in the new model, and this is why the new model is called the inverse relativity theory.

4 DISUSSIONS

Although the results of inverse relativity are opposite to the results of special relativity, this does not represent a contradiction between the two theories, where we find inverse relativity adheres to the postulates, principles, and results of special relativity, and its opposite results are achieved under different observation conditions, but special relativity stops its limits at the paradox of energy and time [16] we mentioned in the first paper, while inverse relativity goes beyond those limits, We also mentioned this in the third paper

Special relativity relies on a single path of linear transformations from one inertial reference frame to another, which are known as Lorentz transformations, , while the inverse relativity has paths for linear transformation, it includes the previous path for linear transformations represented in the transformation from vector $\overrightarrow{\alpha`_0}$ to vector $\vec{\alpha}$ or vice versa, as it has a path of positive space transformations also known as modified Lorentz transformations represented in the transformation from vector $\overrightarrow{\alpha`_0}$ to vector $\vec{\beta}$ or vice versa, and the path of negative space transformations is represented by the transformation from vector $\overrightarrow{\alpha`_0}$ to vector $\overrightarrow{\varphi}$ or vice versa, and thus it reveals to us more about the possible structures within real spacetime (Minkowski spacetime).

The special theory of relativity provided us with one type of time that expresses causality which appears in Minkowski space clearly and has the property of dilation, but in the inverse relativity, the new model has two types of times, The first is time in positive space, and it is the type that preserves the concept of time in special relativity, because the positive space is the space of causality, and this type also has the property of dilation, but inverse relativity reveals to us that there is a second type of time, It is the negative time or separated from causality that has the opposite property, which is contraction.

We also find the concept of negative energy in the model of inverse relativity is not just a negative sign of a quantity of energy that we assume has features, Rather, it is a type of energy that acquires features from the geometrical properties of the space in which it resides, It was previously mentioned in the third paper, We add here another feature to it, which is the possession of super time, we also find that this concept necessarily produces negative mass and negative momentum as well

Special relativity treats light as a wave phenomenon, while inverse relativity through the dimensional rest mass hypothesis made light a mechanical phenomenon more than a wave where it made the wave has mass and do work on it as well, and vice versa, too, where it made the particle with a real rest mass a wave stuck in one of the dimensions of space, This is compatible with the application of both the Lorentz transformations and the modified Lorentz transformations to mechanical and electromagnetic (wave) phenomena, and the total energy transformations also to massless particles and particles with real rest mass

The inverse relativity model may appear to be more of a mathematical model than a physical one because it depends primarily on mathematical analysis, and therefore there is no possibility to test the model or benefit from it, but this model is not intended to establish an independent physical theory with its results as in special relativity, but rather it is a physical-mathematical model specifically created to solve problems of relativistic thermodynamics [14].

Table of comparison between results of special relativity and inverse relativity

Relativistic Variables	Special Relativity	Inverse Relativity
Relativity of Length	$l_R = \grave{l_0}\ \gamma^{-1}$ **or** $l_\alpha = \grave{l}_{\alpha_0}\,\gamma^{-1}$	$l_\beta = \grave{l}_{\alpha_0}$
Relativity of Simultaneity	$\Delta \grave{t}_{\alpha_0} = 0 \qquad \Delta t_\alpha \neq 0$	$\Delta \grave{t}_{\alpha_0} = 0 \qquad \Delta t_\beta = 0$
Relativity of Time	$\Delta t_R = \Delta \grave{t_0}\,\gamma$ **or** $t_\alpha = \grave{t}_{\alpha_0}\ \gamma$	$t_\varphi = \grave{t}_{\alpha_0}\ \gamma^{-1}$
Relativity of Mass	$m_R = \grave{m_0}\,\gamma$ **or** $m_\alpha = \grave{m}_{\alpha_0}\,\gamma$	$m_\beta = \grave{m}_{\alpha_0}\,\gamma^{-1}$
Relativistic Energy	$E_R = \grave{E_0}\ \gamma$ **or** $E_\alpha = \grave{E}_{\alpha_0}\ \gamma$	$E_\beta = \grave{E}_{\alpha_0}\,\gamma^{-1}$
Relativistic Momentum	$\vec{p}_R = m_R \vec{V}$ **or** $\vec{p}_\alpha = m_\alpha\ \vec{V}_\alpha$	$\vec{p}_\beta = \grave{\vec{p}}_{\alpha_0}$

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