Positive and Negative Energy in Inverse Relativity

Michael Girgis

PO box 11000, Gamal Abu Al-Rish str. Tallah, Menia, Egypt

E-mail: michael.grgs@yahoo.com

July 23, 2022

ABSTRACT : As Minkowski space splits into positive and negative space (we mentioned this in the second paper) [1] The energy of the photon and the relativistic kinetic energy of the particle are also analyzed into positive and negative energy, and each type has its properties through the geometrical properties of the space in which it is located, where we find that the energy in the positive space decreases due to dilation of time and It is causally related to observers and their observation devices, so it can be observed, while energy in negative space is causally separate from observers and their observation devices, it cannot be observed, And when the speed of the reference frame reaches the speed of light, theoretically, the positive energy reaches zero and the negative energy reaches infinity, The paper also includes a geometric visualization of the rest mass energy through a new hypothesis known as the dimensional rest energy

Keywords: Relativistic kinetic energy - Relativistic total energy - Dimensional rest mass - Minkowski space splits - Negative energy - Positive energy - Inverse relativity - Energy and time paradox

1 INTRODUCTION

Classical mechanics provided us with one type of energy to describe the motion of a particle, which is the kinetic energy, but after the special theory of relativity was published, new concepts of energy and matter appeared, where we find matter as a form of energy and that the particle while in a state of rest contains a type of energy, which is the rest mass energy and if this type is somewhat ambiguous in addition to the relativistic kinetic energy, and the motion of the particle is described in relativistic mechanics through the sum of these two energies or what is known as relativistic total energy[2], not only that, but special relativity also changed the mathematical formula of the law of kinetic energy followed in classical mechanics, but in the second paper (Modified Lorentz transformations and Minkowski space splits in inverse relativity) [1] we presented a new model known as inverse relativity, does the new model maintain the same previous concepts of energy and matter and the same mathematical formulas When we describe the motion of any particle at speeds close to the speed of light? Or, will the new model go further? And we get a deeper concept of the relationship between energy and matter, or what is the rest mass energy? new mathematical formulas and new types of relativistic kinetic energy and relativistic total energy? The answer to these questions depends on the description of each of the relativistic kinetic energy and the relativistic total energy in positive and negative space through the equations and the geometric properties of each space, which were previously mentioned in the second paper before?

2 METHODS

2-1 The dimensional Rest Mass Hypothesis

According to quantum mechanics, a photon [6] has momentum and has no rest mass, but the rest is relative, like motion when a photon moves at full speed in the y-dimension or yz-plane, the photon's energy will appear to be in a state of rest in the X-dimension, and thus the mass that is equivalent to that energy [9] It is a rest mass relative to X-dimension (dimensional rest mass) and we need to do work in the positive or negative direction of the X-dimension in order for the photon to move in this dimension (Look at Figure 1-3), We can summarize the hypothesis in the following text: “The stuck photon (moving at full speed) in the y-dimension or the yz-plane has a rest mass on the X-dimension and can also acquire work done on it in the positive or negative direction of the rest dimension such as any other particle”, and this hypothesis can also be applied to the relativistic total energy of the particle

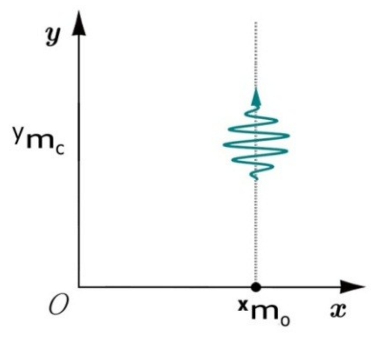

Figure: 1-3

2-2 Photon Energy in Positive Space

We assume that we have two reference frames S and S' from Cartesian coordinate systems [10] [2], each reference frame has an observer at the origin point O and O', and that the frame S' is moving with uniform velocity V_S relative to the S frame in the positive direction of the X-axis, as we suppose that we have in the frame of reference S' a photon moving at full speed on the vector $\overrightarrow{\grave{\alpha}_0}$ in the y'z'-plane between two mirrors, Look at the figure: 2-3

$\grave{S} \rightarrow \grave{x}\ \grave{y}\ \grave{z}\ \grave{t}$

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

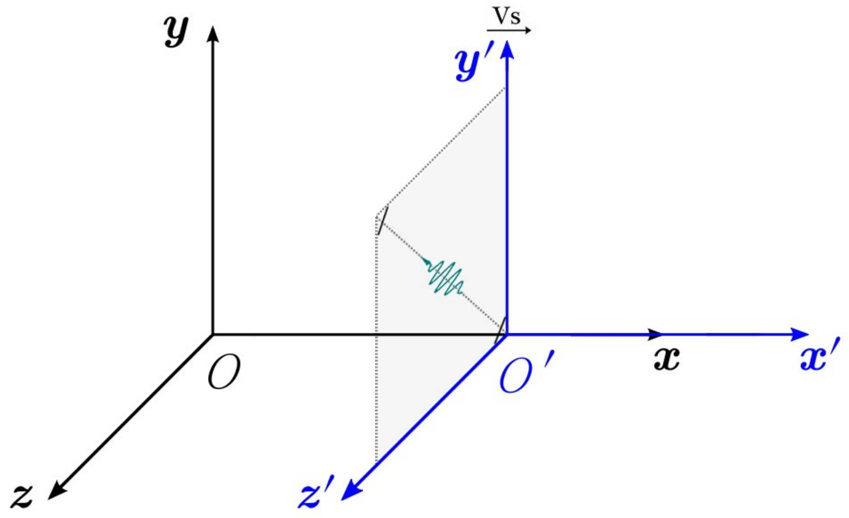

Figure: 2-3

The energy of a photon $\grave{E}_{\alpha_0}$ on the displacement vector $\overrightarrow{\grave{\alpha}_0}$ in the y'z'-plane is the energy of the photon observed by the observer O' relative to the frame of reference S' (i.e., in the first observation conditions), and it is considered rest energy on the X'-dimension according to the previous hypothesis, and equal to the product of Planck's constant h times the frequency of the photon $\grave{\nu}_{\alpha_0}$ on the same vector according to quantum mechanics [5], so it is written in the following formula

$$\grave{E}_{\alpha_0} = h\, \grave{\nu}_{\alpha_0} \tag{1.3}$$

The energy of the photon E_α on the displacement vector $\overrightarrow{\alpha}$ is the energy of the photon observed by the observer O relative to the reference frame S (i.e., also in the first observation conditions), at a moment when the two frames coincide where we allow the photon to reach the observer O[4], because the photon moves in the y'z'-plane, then it will have a rest mass of the X'-dimension relative to the observer O' according to the previous hypothesis, in the case of Vs equal to zero, the photon also has a rest mass of the X-dimension relative to the observer O, and therefore when the frame of reference S moves at a uniform velocity Vs in the positive direction of the X dimension, work must be done on the photon to move on the X-dimension with the reference frame S' according to the previous hypothesis also, the photon acquires this work at every moment of collision with the surface of the mirrors (Look at the figure 2-3), and as a result the total energy increases for a photon by the amount of relativistic work done, and the relativistic total energy of the photon becomes

$$E_\alpha = \grave{E}_{\alpha_0} + W_S \tag{2.3}$$

Where E_α is the relativistic total energy [2] [3] [5] of the photon, $\grave{E}_{\alpha_0}$ the dimensional rest mass energy of the photon, W_S the relativistic work done [8] on the photon and according to special relativity is equal to

$$W_S = \grave{E}_{\alpha_0} \left(\gamma - 1 \right) \tag{3.3}$$

Where **γ** Lorentz factor

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

Substitute from 3.3 into 2.3

$$E_\alpha = \grave{E}_{\alpha_0} + \grave{E}_{\alpha_0} \left(\gamma - 1 \right) \tag{4.3}$$

$$E_\alpha = \grave{E}_{\alpha_0} + \grave{E}_{\alpha_0}\gamma - \grave{E}_{\alpha_0} \tag{5.3}$$

$$E_\alpha = \grave{E}_{\alpha_0}\, \gamma \tag{6.3}$$

Equation 6.3 shows us that the relativistic total energy of the photon E_α observed by the observer O increases with the increase in the velocity of the reference frame V_S (this result agrees with the relativistic Doppler effect in the geometric closest approach [4]), due to the work done on the dimensional rest mass of the photon according to the previous hypothesis, because the photon moves at the speed of light relative to the reference frame S, therefore, the work done here cannot increase the photon's speed according to the second postulate in special relativity [9] [13], so it works to increase the total energy of the photon and also works to analyze the velocity of photon to the two components $\overrightarrow{V_\varphi}$ *and* $\overrightarrow{V_\beta}$, Where $\overrightarrow{V_\varphi}$ represents the photon velocity parallel to the velocity of frame S' on the X-axis, and as a result, the relativistic total energy of the photon is divided by the two vectors $\overrightarrow{\varphi}$, $\overrightarrow{\beta}$

The energy of the photon E_β on the displacement vector $\overrightarrow{\beta}$ is the energy of the photon in the second observation conditions, and is equal to the product of Planck's constant h times the photon frequency ν_β on the same vector according to the principle of inverse relativity (which is the commitment to the principle of special relativity [12] in the second observation conditions), The second observation conditions here are purely mathematical as we mentioned in the second paper (Modified Lorentz transformations and Minkowski space splits in inverse relativity) [1].

$$E_\beta = h\,\nu_\beta \tag{7.3}$$

From the second paper equation 29.2, we get the periodic time transformation of the photon wave in the second observation conditions

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

We take the reciprocal of the equation

$$\frac{1}{t_\beta} = \frac{1}{t\grave{}_{\alpha_0}}\ \gamma^{-1} \tag{8.3}$$

According to classical mechanics, the reciprocal of the periodic time of the wave is equal to the frequency of the wave [10], and thus we get

$$\nu_\beta = \grave{\nu}_{\alpha_0}\ \gamma^{-1} \tag{9.3}$$

Equation 9.3 shows that the frequency ν_β in the second observation conditions decreases from the frequency $\grave{\nu}_{\alpha_0}$ with the increase of the speed of the reference frame Vs, due to the time dilation

By multiplying both sides of equation 9.3 by h Planck's constant

$$h\,\nu_\beta = h\,\grave{\nu}_{\alpha_0}\,\gamma^{-1} \tag{10.3}$$

Substitute from 1.3, 7.3 into 10.3

$$E_\beta = \grave{E}_{\alpha_0}\,\gamma^{-1} \tag{11.3}$$

Equation 3.11 shows that the energy of a photon E_β decreases with increasing velocity V_S, although the work done on the photon increases, the energy E_β is called the positive relativistic total energy because the vector $\overrightarrow{\beta}$ is the vector of positive space, we mentioned this in the second paper[1], and therefore we can say here that the time dilation reduces the relativistic total energy of the photon from the positive space, and when the velocity of the reference frame reaches the speed of light theoretically, and by substituting for that in the previous equation

$$E_\beta = 0 \qquad\qquad V_S = c \tag{12.3}$$

The dilation of time becomes infinity according to Equation 29.2, so the relativistic total energy of the photon is completely reduced from the positive space and its value becomes zero, but where does this energy go?

2-3 Photon Energy in Negative Space

As for the relativistic total energy of the photon on the displacement vector $\overrightarrow{\varphi}$, it is equal to the difference between the relativistic total energy of the photon on the resultant vector $\overrightarrow{\alpha}$ and the relativistic total energy of the photon on the displacement vector $\overrightarrow{\beta}$, according to the law of conservation of energy [3] [10]

$$E_\varphi = E_\alpha - E_\beta \tag{13.3}$$

Substitute from 6.3, 11.3 into 13.3

$$E_{\varphi} = \grave{E}_{\alpha_0}\gamma - \grave{E}_{\alpha_0}\gamma^{-1} \tag{14.3}$$

the smaller amount $\grave{E}_{\alpha_0}\gamma^{-1}$ represents the final energy of the photon after dilation of time, while the larger amount $\grave{E}_{\alpha_0}\gamma$ represents the final energy of the photon after doing work, this means that the decrease in the photon's energy due to the time dilation and the increase in the photon's energy as a result of the work done on the photon appears on the vector $\overrightarrow{\varphi}$

$$E_{\varphi} = \grave{E}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{15.3}$$

Energy E_{φ} is called negative energy because the vector $\overrightarrow{\varphi}$ is the vector of negative space, we mentioned this also in the second paper, so we put a negative sign in the previous equation and write it in the following formula

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

Equation 16.3 shows that the relativistic energy of the photon E_{φ} increases with the increasing velocity V_S, and when the reference frame velocity S' reaches the speed of light theoretically and by substituting for that in the previous equation, we find that the amount of negative energy reaches infinity

$$E_{\varphi} = -\infty \qquad\qquad V_S = c \tag{17.3}$$

We find from equations 11.3, 16.3, with the increase in the velocity of the reference frame V_S the positive energy decreases and the negative energy increases, we conclude that the work done on the dimensional rest mass works to transfer energy from vector $\overrightarrow{\beta}$ to vector $\overrightarrow{\varphi}$, and this means that the dimensional rest mass is the energy resistance to move from the dimension of motion (vector $\overrightarrow{\beta}$) to the dimension of rest (vector $\overrightarrow{\varphi}$), we also find from equations 12.3, 17.3 In order for the positive energy of a photon to be zero in positive space, infinite work must be done, which is not practically possible, therefore we cannot hide or annihilate energy and information (position, velocity, momentum, etc.) of the photon from positive space.

2-4 Relativistic kinetic Energy in Positive Space

But what if we have a particle with real rest mass (such as an electron - a proton - a molecule) and moving with a relativistic velocity (i.e., a velocity close to the speed of light) on the vector $\overrightarrow{\alpha`_0}$ in the y'z'-plane relative to the frame of reference S', It is a little different here where the particle has rest mass energy and relativistic kinetic energy or relativistic total energy relative to the reference frame S', that energy depends on the velocity of particle on the vector $\overrightarrow{\alpha`_0}$ , not on the velocity of the reference frame S', therefore, we assume an imaginary reference frame that moves on the vector $\overrightarrow{\alpha`_0}$ and with the velocity $\vec{V}`_{\alpha_0}$ and write the relativistic mass equation [3] [7] from frame S' to the imaginary frame, according to the special relativity of the following formula.

$$m`_{\alpha_0} = m`_0 \ \gamma`_{\alpha_0} \qquad where \qquad \gamma`_{\alpha_0} = \frac{1}{\sqrt{1 - \frac{V`^2_{\alpha_0}}{c^2}}} \tag{18.3}$$

Where $m`_{\alpha_0}$ is the relativistic mass of the particle on the vector $\overrightarrow{\alpha`_0}$ which is observed by the observer O' relative to the frame of reference S' in the first observation conditions, $\vec{V}`_{\alpha_0}$ is the relativistic velocity of the particle (or the velocity of imaginary frame) relative to the reference frame S', and $m`_0$ the rest mass of the particle observed by the observer O' relative to the reference frame S' when $\vec{V}`_{\alpha_0}$ is zero

By subtracting the amount $m`_0$ from both sides of the equation

$$m`_{\alpha_0} - m`_0 = m`_0 \ \gamma`_{\alpha_0} - m`_0 \tag{19.3}$$

Multiplying both sides of the equation c^2

$$m`_{\alpha_0}c^2 - m`_0 c^2 = m`_0 \, c^2 \ \gamma`_{\alpha_0} - m`_0 \ c^2 \tag{20.3}$$

$$\Delta m`_{\alpha_0}c^2 = m`_0 \, c^2 \left(\gamma`_{\alpha_0} - 1\right) \tag{21.3}$$

The amount $m`_0 \, c^2$ represents the rest mass energy [5] [9] of the particle relative to the frame of reference S' when $\vec{V}`_{\alpha_0}$ is zero, while the amount $\Delta m`_{\alpha_0}c^2$ represents the difference between the rest mass energy and the relativistic total energy [2] [6], which according to special relativity is equal to the work done or relativistic kinetic energy [3] [8] on the vector $\overrightarrow{\alpha`_0}$ relative to the reference frame S'

$$KE`_{\alpha_0} = E`_0 \left(\gamma`_{\alpha_0} - 1 \right) \qquad \vec{V}`_{\alpha_0} < c \tag{22.3}$$

The last equation describes the kinetic energy of the particle relative to the frame of reference S' in relativistic formula, when the velocity of the particle is close to the speed of light, but the velocity of the particle can be much less than the speed of light, because it does not depend on the velocity of the reference frame S', In this case, the relativistic formula reverts to the classical formula for kinetic energy [3]

$$KE`_{\alpha_0} = \tfrac{1}{2} m`_0 \vec{V}`^2_{\alpha_0} \qquad \vec{V}`_{\alpha_0} \ll c \tag{23.3}$$

As for the relativistic kinetic energy of the particle KE_α on the displacement vector $\overrightarrow{\alpha}$, it is the kinetic energy that the observer O observes relative to the reference frame S (i.e., in the first observation conditions), to convert the relativistic kinetic energy from vector $\overrightarrow{\alpha`_0}$ to vector $\overrightarrow{\alpha}$ is through the transformation of mass on the same vectors, which is a transformation between two relativistic masses, so we use here the dimensional rest mass hypothesis, where we assume that the relativistic mass $m`_{\alpha_0}$ is also a rest mass on the X'-dimension relative to the observer O', according to the hypothesis, so that we can transform according to special relativity and the transformation will be as follows

$$m_\alpha = m`_{\alpha_0} \ \gamma \qquad where \qquad \gamma = \frac{1}{\sqrt{1 - \frac{V_S^2}{c^2}}} \tag{24.3}$$

Where m_α is the relativistic mass of the particle on the vector $\overrightarrow{\alpha}$ observed by the observer O relative to the frame of reference S in the first observation conditions, Vs is the velocity of the reference frame S', from the equation we get

$$\Delta m_\alpha = \Delta m`_{\alpha_0} \ \gamma \tag{25.3}$$

Multiplying both sides of the equation c^2

$$\Delta m_\alpha \, c^2 = \Delta m`_{\alpha_0} c^2 \ \gamma \tag{26.3}$$

the amount $\Delta m^{`}_{\alpha_0} c^2$ represents the relativistic kinetic energy of the particle on the vector $\overrightarrow{\alpha`_0}$ as we mentioned earlier, and because it is kinetic energy not a total energy and in the y' z' plane, therefore, it represents part of the rest mass energy on the X'-dimension relative to the observer O' according to the dimensional rest mass hypothesis, while the amount $\Delta m_\alpha c^2$ represents the relativistic kinetic energy [9] of the particle on the vector $\overrightarrow{\alpha}$ that the observer O observes relative to the frame of reference S

$$KE_\alpha = KE^{`}_{\alpha_0}\ \gamma \tag{27.3}$$

Equation 27.3 shows us that the relativistic kinetic energy of the particle KE_α increases with the increasing velocity of the reference frame V_S, due to the work done on the particle with the motion of the reference frame S', but if we want to analyze or divide the energy on the vector $\overrightarrow{\alpha}$ into the two vectors $\overrightarrow{\varphi}$, $\overrightarrow{\beta}$, we cannot use the previous relativistic formula for kinetic energy because it depends on mass only, and it is a scalar quantity that cannot be analyzed, so a new formula must be obtained in which the relativistic kinetic energy depends on the velocity factor next to the mass

To enter the velocity factor with relativistic mass into equation 18.3, we rewrite the equation in the following form

$$m^{`}_{\alpha_0} = m^{`}_0 \left(1 - \frac{\vec{V}^{`2}_{\alpha_0}}{c^2}\right)^{-\frac{1}{2}} \tag{28.3}$$

Then we differentiate the equation with respect to the velocity

$$\frac{dm^{`}_{\alpha_0}}{d\vec{V}^{`}_{\alpha_0}} = -\frac{1}{2} m^{`}_0 \left(1 - \frac{\vec{V}^{`2}_{\alpha_0}}{c^2}\right)^{-\frac{3}{2}} \cdot \frac{d}{d\vec{V}^{`}_{\alpha_0}} \left(1 - \frac{\vec{V}^{`2}_{\alpha_0}}{c^2}\right) \tag{29.3}$$

$$\frac{dm^{`}_{\alpha_0}}{d\vec{V}^{`}_{\alpha_0}} = -\frac{1}{2} m^{`}_0 \left(1 - \frac{\vec{V}^{`2}_{\alpha_0}}{c^2}\right)^{-\frac{3}{2}} \cdot \frac{-2\vec{V}^{`}_{\alpha_0}}{c^2} \tag{30.3}$$

$$\frac{dm^{`}_{\alpha_0}}{d\vec{V}^{`}_{\alpha_0}} = \frac{m^{`}_0\ \vec{V}^{`}_{\alpha_0}}{c^2 \left(1 - \frac{\vec{V}^{`2}_{\alpha_0}}{c^2}\right)^{\frac{3}{2}}} \tag{31.3}$$

Substitute from 18.3 into 31.3

$$\frac{dm\grave{}_{\alpha_0}}{d\vec{V}\grave{}_{\alpha_0}} = \frac{m\grave{}_{\alpha_0}\ \vec{V}\grave{}_{\alpha_0}}{c^2\left(1-\frac{\vec{V}\grave{}^{2}_{\alpha_0}}{c^2}\right)} \tag{32.3}$$

$$\frac{dm\grave{}_{\alpha_0}}{d\vec{V}\grave{}_{\alpha_0}} = \frac{m\grave{}_{\alpha_0}\ \vec{V}\grave{}_{\alpha_0}}{\left(c^2-\vec{V}\grave{}^{2}_{\alpha_0}\right)} \tag{33.3}$$

$$dm\grave{}_{\alpha_0}\left(c^2-\vec{V}\grave{}^{2}_{\alpha_0}\right) = m\grave{}_{\alpha_0}\ \vec{V}\grave{}_{\alpha_0}\, d\vec{V}\grave{}_{\alpha_0} \tag{34.3}$$

$$dm\grave{}_{\alpha_0}\, c^2\ dm\grave{}_{\alpha_0}\, \vec{V}\grave{}^{2}_{\alpha_0} = m\grave{}_{\alpha_0}\ \vec{V}\grave{}_{\alpha_0}\, d\vec{V}\grave{}_{\alpha_0} \tag{35.3}$$

$$dm\grave{}_{\alpha_0}\, c^2 = dm\grave{}_{\alpha_0}\, \vec{V}\grave{}^{2}_{\alpha_0} + m\grave{}_{\alpha_0}\, \vec{V}\grave{}_{\alpha_0}\, d\vec{V}\grave{}_{\alpha_0} \tag{36.3}$$

The left side of the equation represents an infinitesimal amount of relativistic kinetic energy on the vector $\overrightarrow{\alpha\grave{}_0}$

$$dm\grave{}_{\alpha_0}\, c^2 = dKE\grave{}_{\alpha_0} \tag{37.3}$$

Substitute from 37.3 into 36.3

$$dKE\grave{}_{\alpha_0} = dm\grave{}_{\alpha_0}\, \vec{V}\grave{}^{2}_{\alpha_0} + m\grave{}_{\alpha_0}\, \vec{V}\grave{}_{\alpha_0}\, d\vec{V}\grave{}_{\alpha_0} \tag{38.3}$$

Equation 38.3 represents the relativistic kinetic energy of the particle on the vector $\overrightarrow{\alpha\grave{}_0}$ according to special relativity but in differential form [3]. In a similar way, we can describe the relativistic kinetic energy of the particle on the vector $\overrightarrow{\alpha}$ relative to the frame of reference S by the following differential formula

$$dKE_\alpha = dm_\alpha\ \vec{V}^2_\alpha + m_\alpha\ \vec{V}_\alpha\ d\vec{V}_\alpha \tag{39.3}$$

The differential formula includes the velocity factor and the mass factor together as in the classical formula for kinetic energy, and therefore we can here analyze the relativistic kinetic energy, where the velocity vector $\overrightarrow{V_\alpha}$ is analyzed into two components $\overrightarrow{V_\beta}$ and $\vec{V}_\varphi$ We mentioned this in the second paper, but the mass m_α it is a scalar quantity do not accept analysis, so the relativistic kinetic energy of the particle on the vector $\overrightarrow{\beta}$ is written in the following differential formula

$$dKE_\beta = dm_\alpha \ \vec{V}_\beta^2 + m_\alpha \ \vec{V}_\beta \ d\vec{V}_\beta \tag{40.3}$$

Where dKE_β is an infinitesimal amount of the relativistic kinetic energy on the vector $\overrightarrow{\beta}$, and $\overrightarrow{V_\beta}$ is the particle's velocity on the vector $\overrightarrow{\beta}$, to convert the relativistic kinetic energy from the vector $\overrightarrow{\alpha`_0}$ to $\overrightarrow{\beta}$, we must obtain the transformation of the mass m_α (we have already obtained this) and the velocity $\overrightarrow{V_\beta}$ and this will be through the transformations of the velocity vectors the second paper of equation 58.2 [1]

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

We write equation 58.2 in differential form

$$d\vec{V}_\beta = d\vec{V}_{\alpha_0}^{`} \ \gamma^{-1} \tag{41.3}$$

We write equation 24.3 in differential form

$$dm_\alpha = dm_{\alpha_0}^{`} \ \gamma \tag{42.3}$$

Substitute from 42.3, 58.2, 24.3, 41.3 into 40.3

$$dKE_\beta = dm_{\alpha_0}^{`} \ \gamma \ d\vec{V}_{\alpha_0}^{`2} \ \gamma^{-2} + m_{\alpha_0}^{`} \ \gamma \ d\vec{V}_{\alpha_0}^{`} \ \gamma^{-1} \ \vec{V}_{\alpha_0}^{`} \ \gamma^{-1} \tag{43.3}$$

$$dKE_\beta = dm_{\alpha_0}^{`} \ d\vec{V}_{\alpha_0}^{`2} \ \gamma^{-1} + m_{\alpha_0}^{`} \ d\vec{V}_{\alpha_0}^{`} \ \vec{V}_{\alpha_0}^{`} \ \gamma^{-1} \tag{44.3}$$

$$dKE_\beta = \left(dm_{\alpha_0}^{`} \ d\vec{V}_{\alpha_0}^{`2} + m_{\alpha_0}^{`} \ d\vec{V}_{\alpha_0}^{`} \ \vec{V}_{\alpha_0}^{`} \right) \gamma^{-1} \tag{45.3}$$

Substitute from 38.3 into 45.3

$$dKE_\beta = dKE_{\alpha_0}^{`} \ \gamma^{-1} \tag{46.3}$$

By the definite integration of both sides of the equation

$$\int_0^{KE_\beta} dKE_\beta = \gamma^{-1} \int_0^{KE_{\alpha_0}^{`}} dKE_{\alpha_0}^{`} \tag{47.3}$$

$$KE_\beta = KE_{\alpha_0}^{`} \ \gamma^{-1} \tag{48.3}$$

Equation 48.3 shows us that the relativistic kinetic energy KE_β decreases with increasing velocity V_S, although the differential formula for kinetic energy in Equation 40.3 contains the relativistic mass factor (or mass increase), but we find the effect of time dilation here is greater, and the energy KE_β is also called positive relativistic kinetic energy, because the vector $\overrightarrow{\beta}$ is the vector of positive space as we mentioned earlier, and when the velocity of the reference frame reaches the speed of light theoretically, and by substituting for that in the previous equation, Time dilation becomes infinite according to equation 29.2, and therefore the positive kinetic energy is completely reduced from the positive space and its value becomes zero, which is the same result that we obtained in equation 12.3

$$KE_{\beta} = 0 \qquad\qquad V_S = c \tag{49.3}$$

The positive energy properties, whether of a photon or a particle of real mass, depend on the geometric properties of positive space, Where we find the time dilation in this space reduces the velocity according to the second paper, and reducing the velocity here leads to a reduction in the relativistic kinetic energy of the particle and in the relativistic total energy of the photon until it reaches zero when the time dilation reaches infinity, and we also find the causality [15] in positive space it is symmetric for all observers, Thus, we can describe positive energy as the energy associated with causality or the energy exchanged between colliding particles (you can return to the collision example in the second paper), Therefore, both observers can observe this energy on the observation devices when it is causal (in other words, when the particle containing this energy is in a collision) with the observers or their observation devices

2-5 Relativistic kinetic Energy in Negative Space

As for KE_{φ} the relativistic kinetic energy on the velocity vector $\overrightarrow{V_{\varphi}}$ it is equal according to the law of conservation of energy [3] [10] the difference between the relativistic kinetic energy on the net velocity vector $\overrightarrow{V_{\alpha}}$ and the relativistic kinetic energy on the velocity vector $\overrightarrow{V_{\beta}}$

$$KE_{\varphi} = KE_{\alpha} - KE_{\beta} \tag{50.3}$$

Substitute from 48.3, 27.3 into 50.3

$$KE_{\varphi} = K\grave{E}_{\alpha_0}\,\gamma - K\grave{E}_{\alpha_0}\,\gamma^{-1} \tag{51.3}$$

$$KE_{\varphi} = K\grave{E}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{52.3}$$

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

$$KE_{\varphi} = -K\grave{E}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{53.3}$$

Equation 53.3 shows us that the negative relativistic kinetic energy KE_{φ} increases with the increasing velocity V_S, and when the velocity of the reference frame reaches the speed of light theoretically and by substituting for that in the previous equation, we find that the negative energy reaches infinity (theoretically), which is the same result which we get in equation 17.3

$$KE_{\varphi} = -\infty \qquad\qquad V_S = c \qquad (54.3)$$

The properties of negative energy depend on the geometric properties of negative space, we know from the second paper that negative space is a non-causal space, meaning that there is no causality, Therefore, we can describe negative energy here as energy outside of any causality, so none of the observers can observe this energy on observation devices because it is causally separate from the observers and their observation devices, (You can go back to the collision example in the second paper), One of the properties of negative space is also that the velocity vectors are parallel in direction and equal in magnitude to the velocity of the reference frame V_S, so we can describe negative energy as parallel energy to the space of each observer, in the above examples, it is parallel to the observer's space O', but if we assume the motion of the reference frame S in the negative direction of the X-axis, It will be parallel to the observer space O.

3 RESULTS

As we have done in the second paper (Modified Lorentz Transformations and Minkowski space splits in inverse relativity) to analyze the displacement and velocity vector of the particle in the reference frame into two vectors, each vector resulting from the analysis process is represented in its own space, one is positive and the other is negative, here we will also analyze each of the energy of photon and the relativistic kinetic energy of the particle on these two vectors, and thus we get new types of energy, the properties of each type depend on the geometric properties of the space in which it is located, the energy that exists in 4D positive space is called positive energy, where we find the time dilation in this space reduces the positive energy until It reaches zero when the time dilation reaches infinity, and we also find the causality in the positive space is symmetric for all observers, so this energy can be in causation with any of the observers or their observation devices, which can be observed, As for the energy that exists in a 4D negative space, it is called negative energy, and because negative space is a space without causality, therefore, this energy is always outside of any causality, whether with observers or their observation devices, This means that it cannot be observed, We can also describe negative energy as the parallel energy of space of each observer, as we find that the work done on the dimensional rest mass works to transfer energy from the vector $\overrightarrow{\beta}$ to the vector $\overrightarrow{\varphi}$, and therefore the dimensional rest mass is the resistance of the energy to move from the dimension of motion to the dimension of rest, and in order for the positive energy to reach zero theoretically, infinite work must be done, this is not possible from the practical side, Therefore, the positive space retains both the energy and information of the particle

4 DISUSSIONS

in special relativity according to the first paper [16] (Energy and Time Paradox Limits of Special Relativity in Practice), we find that time dilation and mass increase appear together on the same vector $\overrightarrow{\alpha}$ in the same frame of reference S, this leads to a decrease and an increase in the frequency of the photon or energy in generally on the same vector $\overrightarrow{\alpha}$, which forms a paradox in the phenomenon of annihilation of two pairs of particles and a paradox in the temperature transformation in relativistic thermodynamics [14], but in the new model of inverse relativity, the displacement vector $\overrightarrow{\alpha}$ is analyzed into the two displacement vectors $\overrightarrow{\beta}$ and $\overrightarrow{\varphi}$, where we find that the photon's frequency or energy decreases on the vector $\overrightarrow{\beta}$ due to the time dilation (although taking into account the increase in mass but the time dilation has the largest effect), as we find that the frequency of the photon or the energy increase on the vector $\overrightarrow{\varphi}$ (where the increase in mass here has the greatest effect), and both vectors are in the same frame of reference S, and this means that the energy decreases and increases at the same time for the observer O, according to the observation process used by the observer, if he is observing relative to himself (the first observation conditions) or if he is observing relative to the other observer (the second observation conditions), and this is a theoretical solution to the paradox of energy and time

In special relativity also, the concept of energy was associated with the velocity factor of the particle, when the velocity is zero, i.e. the particle is in a state of rest, it has the energy of rest mass, and when it has a speed close to the speed of light, it has a relativistic kinetic energy, while in the new model we find that the concept of energy is associated with causality factor [15] Or the direction of the velocity vector of the particle, where we find the energy associated with causality and called positive energy, which is the energy that can be observed in nature, and energy separate from causality and called negative energy, which is energy that cannot be observed despite its presence in nature, and thus the new model reveals to us new types of energy has new mathematical formulas as well, other than the formulas used in special relativity

We also find the concept of rest mass energy in special relativity from the mysterious concepts, Where all special relativity tells us is the amount of energy that can be converted into matter or vice versa according to the famous equation $E = m\,c^2$ [9], but it did not provide any conception of the nature of the energy of the rest mass, while we find in the new model of inverse relativity the hypothesis of the dimensional rest mass is a geometric conception of the energy of the rest mass, It can be the energy of a photon or the relativistic kinetic energy of a particle stuck in one or two dimensions of spatial space, where it appears in the third dimension as rest mass energy, meaning that the rest mass energy is the geometry of energy on the space, while the rest mass is the resistance of energy to move from a dimension of motion to a dimension of rest in space

Types of energy	**Special Relativity**	**Inverse Relativity**
Transformation of Relativistic Total Energy	$E_\alpha = \grave{E}_{\alpha_0}\ \gamma$ or $E_{total} = \grave{E}_{rest}\ \gamma$	$E_\beta = \grave{E}_{\alpha_0}\ \gamma^{-1}$ $E_\varphi = -\grave{E}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right)$
Transformation of Relativistic Kinetic Energy	$KE_\alpha = K\grave{E}_{\alpha_0}\ \gamma$	$KE_\beta = K\grave{E}_{\alpha_0}\ \gamma^{-1}$ $KE_\varphi = -K\grave{E}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right)$
The rest Mass Energy	$\grave{E}_0 = \grave{m}_0\, c^2$	$\grave{E}_{\alpha_0} = h\, \grave{\nu}_{\alpha_0}$ or $\grave{E}_{\alpha_0} = \grave{m}_0\, \grave{\gamma}_{\alpha_0}$

References

[1] Michael Girgis (2022). "Modified Lorentz Transformations and Minkowski space splits in inverse relativity" viXra:2206.0017

[2] Albert Einstein (2001). *Relativity: The Special and the General Theory* (Reprint of 1920 translation by Robert W. Lawson), *p. 5.14. 55*

[3] *R.C. Tolman (1934), Relativity, Thermodynamics, and Cosmology, Oxford: Clarendon Press,* Reissued (1987), New York: Dover, *p.2, 47, 48*, *120*

[4] Morin, David (2008). "Chapter 11: Relativity Kinematics)" (PDF). *Introduction to Classical Mechanics: With Problems and Solutions, p.* XI-34

[5] D.J. Griffiths (1987). *Introduction to Elementary Particles*. Wiley, *p.14,90, 105*

[6] Daphne Anne Caligari Conti (2014). " What is a Photon" *(PDF).* ResearchGate

[7] *Roche, J (2005). "What is mass?" (PDF). European Journal of Physics.*

[8] A. Einstein (1905), "Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?" , *Annalen der Physik* [Does the Inertia of a Body Depend Upon Its Energy Content?]

[9] Günther, Helmut; Müller, Volker (2019), Günther, Helmut; Müller, Volker (eds.), The Special Theory of Relativity: Einstein's World in New Axiomatics, Singapore: Springer, *p. 92.98. 101*

[10] RG Takwale (1980). *Introduction to classical mechanics*. New Delhi: Tata McGraw-Hill. *p.69, 89, 101*

[11] Citation: W.-M. Yao et al. (Particle Data Group), J. Phys. G 33, 1 (2006)

[12] Einstein, A., Lorentz, H. A., Minkowski, H., & Weyl, H. (1952). The Principle of Relativity: a collection of original memoirs on the special and general theory of relativity. Courier Dover Publications. p. 111

[13] Albert Einstein (1905) "*Zur Elektrodynamik bewegter Körper*", *Annalen der Physik* 17: 891; English translation On the Electrodynamics of Moving Bodies by George Barker Jeffery and Wilfrid Perrett (1923)

[14] Tadas K. Nakamura (2912) "Three Views of a Secret in Relativistic Thermodynamics"

[15] Minkowski space From Wikipedia, the free encyclopedia

[16] Michael Girgis (2022). " The Energy-Time Paradox Limits of Special Relativity in Practice" viXra:2202.0150