Relativistic Thermodynamics Transformations According to Inverse Relativity

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ABSTRACT : inverse relativity as a new physical model is combined with thermodynamics to obtain relativistic transformations of thermodynamic variables such as volume, pressure and temperature, from the modified Lorentz transformations of space coordinates in inverse relativity, we get one transformation of volume, and from the energy transformations in inverse relativity, we get only one temperature transformation, and through transformations of the volume and temperature of the gas, we also get only one transformation of the pressure of the gas, and thus we have one model for relativistic thermodynamics, which is what special relativity failed in, the single model also includes how to solve relativistic thermodynamics problems resulting from special relativity, this shows us the superiority of inverse relativity over special relativity in application.

Keywords: Relativistic Thermodynamics - Energy -time paradox - Inverse Relativity - Modified Lorentz transformations – Super time - Negative space - Lorentz volumes paradox - Michael Gerges paradoxes

1 INTRODUCTION

We have previously explained in the first paper entitled the energy-time paradox [6] the failure of special relativity in merging with thermodynamics, where this paradox revealed to us the possibility of obtaining more than one transformation of energy related to temperature, and therefore we were able to obtain different conversions of temperature in the same frame of reference [7], as there is no possibility to distinguish between one energy transformation and another, as we explained in the sixth paper titled Lorentz volumes paradox [4], obtaining different transformations for thermodynamic volumes, because of these paradoxes, physicists were unable to obtain only one model of relativistic thermodynamics through special relativity, and we have a number of models that contradict each other, as we showed in papers one and Six, these paradoxes do not represent an error in special relativity, but rather they only reveal to us the limits of special relativity as a physical model in application, and that its limits stop at merging with thermodynamics, Therefore, we sought to create a new physical model known as inverse relativity, where the main purpose of this model is to establish only one model of relativistic thermodynamics. Can the new model solve the previous paradoxes? Can inverse relativity establish a single model of relativistic thermodynamics and surpass special relativity, prove its seriousness, and achieve the primary purpose of its creation? The answer to these questions depends on the number of possible transformations for each thermodynamic variable that can be obtained from merging inverse relativity with thermodynamics.

2 METHODS

2-1 The thermodynamic System within Reference Frames

We assume that we have two reference frames S and [1] S' from orthogonal coordinate systems, each reference frame has an observer at the origin point 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, and we also assume that the frame of reference S' contains a closed thermodynamic system of ideal gas and in thermodynamic equilibrium, as shown in the following figure

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

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

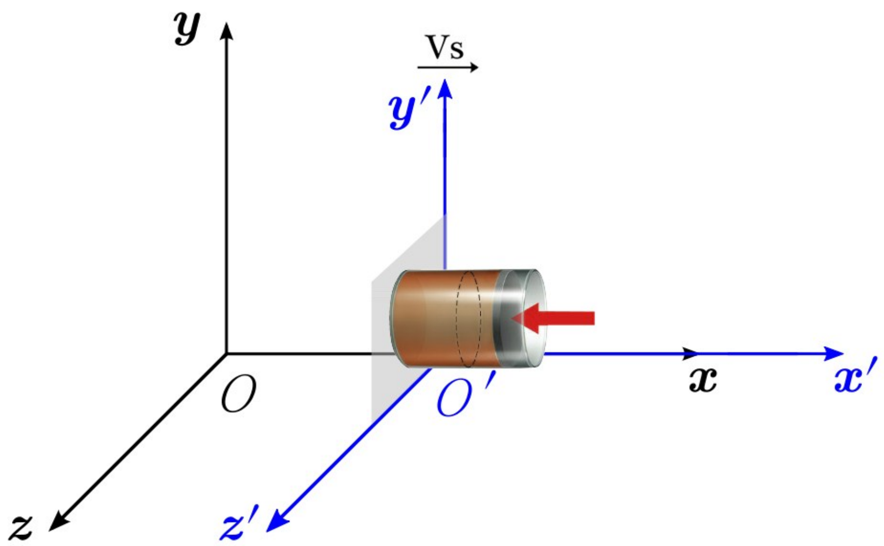

Figure 1:6

2-2 Gas Volume Transformation and Solving Lorentz Volumes Paradox

The observer O' observes the variables of the thermodynamic system relative to the frame of reference S', such as the amount of gas or the number of molecules *N*, the volume of gas $V`_{\alpha_0}$ It is the volume of space that contains the gas, gas pressure $P`_{\alpha_0}$ and the temperature of gas $T`_{\alpha_0}$, As we mentioned in the sixth paper, we use the vector symbol $\overrightarrow{\alpha`_0}$ on both volume, pressure and temperature, although they are non-vector scalar quantities, because the vector $\overrightarrow{\alpha`_0}$, It represents the 3D instantaneous displacement vector of gas molecules that is related to the previous scalar quantities, and this vector also represents the first observation conditions according to inverse relativity, while the symbol 0 expresses the occurrence of the event (the thermodynamic system) in the frame of reference S'

in order to get a transformation of the volume of the gas from frame of reference S' to frame S, but in the second observation conditions, i.e. According to inverse relativity, we must first obtain the dimensionality transformation of the volume as we did in the sixth paper, but here we use the inverse modified Lorentz transformations of the space coordinates of inverse relativity according to the second paper [3] , instead of the Lorentz transformations [1]

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

$$y_\beta = y`_{\alpha_0} \tag{27.2}$$

$$z_\beta = z`_{\alpha_0} \tag{28.2}$$

Where $\vec{\beta}$ is the 3D instantaneous displacement vector of the gas molecules observed by the observer O in the reference frame S, but in the second observation conditions or according to the observation conditions of inverse relativity, It is also used with the scalar quantities that are related to this vector to express the second observation conditions. Because the geometrical dimensions of the shape of the thermodynamic system can be represented on the coordinates of the reference frame S', as length periods on each coordinate, so we write the previous set of equations in the following form

$$\Delta x_\beta = \Delta x`_{\alpha_0} \tag{1.7}$$

$$\Delta y_\beta = \Delta y`_{\alpha_0} \tag{2.7}$$

$$\Delta z_\beta = \Delta z`_{\alpha_0} \tag{3.7}$$

The transformations of length periods of the space coordinates (geometric dimensions of the thermodynamic system) from the reference frame S' to the frame S are characterized by symmetry in the second observation conditions, as a result of the symmetry of the space coordinates in the modified Lorentz transformations as shown in the first set of equations. Therefore, the gas volume transformation from the frame of reference S' to frame S in the second observation conditions is also symmetric

$$V_\beta \ = \ V`_{\alpha_0} \tag{4.7}$$

Where V_β is the gas volume observed by the observer O in the reference frame S but in the second observation conditions or in the positive space, Equation 4.7 shows that the observer O observes the relativistic gas volume constant in the second observation conditions with the increase in the speed of the reference frame Vs, as a result of spatial symmetry in the positive 4D space, we can also obtain an equation similar to the conversion of the volume of each gas molecule in the second observation conditions, and it is written in the following formula

$$\hat{V}_\beta = \ \hat{V}`_{\alpha_0} \tag{5.7}$$

Where $\hat{V}`_{\alpha_0}$ is the volume of one molecule of gas, $\hat{V}_\beta$ is the relativistic volume of the molecule in the second observation conditions or in the positive space, by multiplying both sides of the equation by the number of gas molecules N we obtain the transformation of the sum of the volumes of the gas molecules from the reference frame S' to the reference frame S in the second observation conditions

$$N\,\hat{V}_\beta = N\,\hat{V}`_{\alpha_0} \tag{6.7}$$

By dividing Equation 4.7 by Equation 6.7

$$\frac{V_\beta}{N\,\hat{V}_\beta} = \frac{V`_{\alpha_0}}{N\,\hat{V}`_{\alpha_0}} \tag{7.7}$$

As we know from the sixth paper [4] the right side of equation 7.7 represents the rational volume $\bar{V}`_{\alpha_0}$ which is also a thermodynamic variable, while the left side represents the rational volume transformation $\bar{V}_\beta$, but in the second observation conditions

$$\bar{V}_\beta \ = \ \bar{V}`_{\alpha_0} \tag{8.7}$$

We conclude from equation 8.7, 4.7, that in the conditions of the second observation, the conversion of the gas volume from the reference frame S' to the frame S is exactly the same as the conversion of the rational volume from the frame S' to the frame S, that is, in inverse relativity, the different types of thermodynamic volumes have same transformation, Or in other words, the modified Lorentz transformations of the spatial coordinates lead to one result for different volumes in the same frame of reference. Therefore, there is no Lorentz volumes paradox [4] here, because both types of volumes will have the same effect on the relativistic gas pressure under the same assumptions previously mentioned in the sixth paper (constant temperature and constant quantity of gas), It is the matter in which special relativity or Lorentz transformations failed and resulted in the Lorentz volume paradox, This shows us the success of the modified Lorentz transformations in solving the paradox, and thus the success of inverse relativity as a new physical model in solving one of the problems that appear when establishing relativistic thermodynamics

2-3 Gas Temperature Transformation and Solving The energy-time Paradox

Because the thermodynamic system contains an ideal gas, therefore, it is subject here to Kinetic theory of gases. This theory combines the macroscopic variables of the thermodynamic system with the microscopic variables of it, where we find that the absolute temperature of the gas is proportional to the average kinetic energy of the gas molecules [2], Thus, the observer O' gets the relations between the temperature and the average kinetic energy of the molecule relative to the reference frame S' according to the following equation

$$\overline{KE}`_{\alpha_0} = \frac{3}{2}\, k\; T`_{\alpha_0} \qquad\qquad \vec{V}`_{\alpha_0} \ll c \tag{9.7}$$

Where $\overline{KE}`_{\alpha_0}$ is the average kinetic energy of the molecule on the vector $\overrightarrow{\alpha`_0}$ when the particle velocity $\vec{V}`_{\alpha_0}$ is much less than the speed of light, $k$ Boltzmann constant, $T`_{\alpha_0}$ is the absolute temperature resulting from the same vector, using the same mathematical formula, the observer O obtains the relation between the temperature and the average kinetic energy of the molecule on the vector $\vec{\beta}$ in the reference frame S in the second observation conditions or in the positive space according to the principle of inverse relativity

$$\overline{KE}_{\beta} = \frac{3}{2}\, k\, T_{\beta} \tag{10.7}$$

Where $\overline{KE}_\beta$ average kinetic energy of the molecule on the vector $\overrightarrow{\beta}$, T_β is the relativistic temperature resulting from the same vector $\overrightarrow{\beta}$, thus, we find here the conversion of the gas temperature from the frame S' to the frame S in the second observation conditions or according to inverse relativity depends on the conversion of the kinetic energy of the molecules, we can obtain the conversion of the kinetic energy in the second observation conditions or from the vector $\overrightarrow{\alpha`_0}$ to the vector $\overrightarrow{\beta}$ from inverse relativity the third paper [5] Equation No. 48.3

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

From it, we get the transformation of the average kinetic energy

$$\overline{KE}_\beta = \overline{KE}`_{\alpha_0}\ \gamma^{-1} \tag{11.7}$$

Substitute from 9.7, 10.7 into 11.7

$$\frac{3}{2}\ k\ T_\beta = \frac{3}{2}\ k\ T`_{\alpha_0}\ \gamma^{-1} \tag{12.7}$$

$$T_\beta = T`_{\alpha_0}\ \ \gamma^{-1} \tag{13.7}$$

We can also write the previous equation in the following form

$$T_\beta\ = T`_{\alpha_0}\ \sqrt{1 - \frac{V_S^2}{c^2}} \tag{14.7}$$

Equation 14.7 shows that the observer O observes the relativistic temperature of the gas in the second observation conditions decreases with the increase in the speed of the reference frame Vs, As a result of reducing the time dilation of the kinetic energy on the vector $\overrightarrow{\beta}$ or from the positive space in general according to inverse relativity, And when the speed Vs theoretically reaches the speed of light, and by substituting for it in the previous equation, we find that the relativistic temperature reaches absolute zero.

$$T_\beta\ = 0\ °K \qquad\qquad V_S\ = c \tag{15.7}$$

Although there is another conversion of kinetic energy in inverse relativity from vector $\overrightarrow{\alpha`_0}$ to vector $\overrightarrow{\varphi}$ for the molecules of gas, a conversion in which the kinetic energy increases on the vector $\overrightarrow{\varphi}$ in the frame of reference S, but according to inverse relativity, the vector $\overrightarrow{\varphi}$ is the vector of negative space, that is, the space devoid of causality, Therefore, the kinetic energy of the molecule on this vector is negative energy, that is, energy that does not exchange when the gas molecules collide with each other or with the walls of the thermodynamic system, in other words, energy outside any causality that occurs within this system. Therefore, this vector also does not express thermodynamic phenomena such as pressure, thermodynamic equilibrium, or Heat transfer between the system and its surroundings. As for the vector $\overrightarrow{\beta}$ according to inverse relativity, it is the vector of the positive space or the space of causality, and therefore the kinetic energy of the molecule on this vector is the energy that exchanges when the gas molecules collide with each other or with the wall of the thermodynamic system, That is, it is the one that represents the previous thermodynamic phenomena, and thus we have one result for the conversion of energy associated with temperature, which is something that special relativity failed to do.

where when converting the kinetic energy of the molecule in special relativity from the vector $\overrightarrow{\alpha`_0}$ to the vector $\overrightarrow{\alpha}$ we get an increase in energy on the vector $\overrightarrow{\alpha}$ due to the increase in mass, and we also get a decrease in energy on the same vector $\overrightarrow{\alpha}$ because of time dilation or falling into the energy-time paradox, we explained this in the first paper [6], We cannot here specify the energy conversion that is related to the temperature because both transformations are on the same vector or in the same observation conditions. As a result, there is more than one temperature conversion or more than one result of the relativistic temperature in the same frame of reference.

As for the different kinetic energy conversions in inverse relativity, as we mentioned above, they are on two vectors $\overrightarrow{\beta}$,$\overrightarrow{\varphi}$ and not on the same vector $\overrightarrow{\alpha}$ as in special relativity, Thus, each energy conversion represents a different type of energy that acquires geometric properties through its own vector., Thus, inverse relativity was able to solve the paradox of energy and time, and solve the problem that resulted from that in relativistic thermodynamics, which is to determine the energy conversion that is related to temperature through the geometric properties of each type of energy

2-4 Gas Pressure Transformation

We can get the gas pressure conversion through the gas volume and temperature transformations, where according to the general ideal gas equation [2] the observer O' gets the relations between each of the volume, pressure, absolute temperature and the amount of gas relative to the frame of reference S' as we explained in Sixth paper

$$P`_{\alpha_0}\, V`_{\alpha_0} = N\, k\, T`_{\alpha_0} \tag{12.6}$$

Where k is a Boltzmann constant and N is a constant number because the system is closed, as mentioned above

$$\frac{P`_{\alpha_0}\, V`_{\alpha_0}}{T`_{\alpha_0}} = N\, k \tag{13.6}$$

because the absolute temperature is a thermodynamic variable, therefore, the decrease in the relativistic temperature will have an effect on the relativistic gas pressure when the relativistic gas volume is constant, and using the same mathematical formula, the observer O obtains the relations between volume, pressure and temperature relative to the reference frame S in the second observation conditions or according to the principle of inverse relativity

$$\frac{P_\beta\ V_\beta}{T_\beta} = N\, k \tag{16.7}$$

Substitute from 13.6 into 16.7

$$\frac{P_\beta\ V_\beta}{T_\beta} = \frac{P`_{\alpha_0}\, V`_{\alpha_0}}{T`_{\alpha_0}} \tag{17.7}$$

Substitute from 4.7, 13.7 into 17.7

$$\frac{P_\beta\ V`_{\alpha_0}}{T`_{\alpha_0}\ \gamma^{-1}} = \frac{P`_{\alpha_0} V`_{\alpha_0}}{T`_{\alpha_0}} \tag{18.7}$$

$$P_\beta = P`_{\alpha_0}\ \gamma^{-1} \tag{19.7}$$

$$P_\beta = P`_{\alpha_0} \sqrt{1 - \frac{V_S^2}{c^2}} \tag{20.7}$$

We conclude from equation 20.7 that the relativistic gas pressure observed by the observer O relative to the reference frame S decreases with the increase in the speed of the reference frame Vs, and that is due to the decrease in the relativistic temperature, According to the kinetic theory of gases, the gas pressure as a macroscopic variable of the thermodynamic system also depends on the microscopic variable, which is the momentum with which particles collide with the wall of the system, where the pressure of the gas $P`_{\alpha_0}$ relative to the reference frame S' depends on the momentum $\overrightarrow{p`}_{\alpha_0}$, while the relativistic pressure in the reference frame S depends on the momentum of the particles in the positive space $\overrightarrow{p_\beta}$, because it is the momentum of causality or the momentum with which the gas molecules collide with each other and with the wall of the system. Therefore, energy also exchanges on this vector, as mentioned above, As for the momentum $\overrightarrow{p_\varphi}$ of the particles, it does not represent any pressure in the system, because it is the momentum of the negative space, that is, outside of any collision or causality that occurs in the system, and therefore the energy on this vector does not exchange between the particles, as we also mentioned above, we can now arrange the set of equations 4.7, 13.7, 19.7, It represents relativistic transformations of thermodynamic variables according to inverse relativity

$$V_\beta \; = \; V`_{\alpha_0} \tag{4.7}$$

$$T_\beta = \; T`_{\alpha_0} \;\; \gamma^{-1} \tag{13.7}$$

$$P_\beta \; = P`_{\alpha_0} \; \gamma^{-1} \tag{19.7}$$

3 RESULTS

When combining inverse relativity with thermodynamics, to obtain relativistic transformations of thermodynamic system variables such as volume, pressure and temperature, where we obtain from the modified Lorentz transformations of space coordinates in inverse relativity one transformation for both thermodynamic volumes, i.e. a similar conversion for each of the gas volume and the rational volume between the volume of the gas and the volume of its molecules, and this is a solution to the Lorentz volume paradox shown in the sixth paper. We also get from inverse relativity one energy conversion that is related to the temperature of the gas. Thus, We also get one transformation of temperature , and this is also a solution to the paradox of energy and time shown in the first paper, and by converting the volume of gas and the temperature of the gas, we can also obtain one conversion of the gas pressure, because each thermodynamic variable follows a single path of transformation, Thus, the relativistic transformations of the variables express only one model of relativistic thermodynamics, unlike the combination of special relativity with thermodynamics, which gives us a number of models of relativistic thermodynamics because of the aforementioned paradoxes. Thus, inverse relativity is superior to special relativity in its application to thermodynamics, and it succeeds in achieving the main purpose of its creation.

4 DISUSSIONS

In the item of temperature transformation, we assumed that the speed of the gas particles is much less than the speed of light, meaning that the temperature of the gas is low, but in the case if the speed of the gas particles is close to the speed of light, that is, the gas is at high temperatures, the mathematical formula between the temperature of the system and the average kinetic energy of the particles differs slightly [2]

$$\overline{KE}`_{\alpha_0} = 3\,k\,T`_{\alpha_0} \qquad\qquad \vec{V}`_{\alpha_0} < c \tag{23.7}$$

But by following the same previous steps in the temperature transformation item, we get the same previous conversion equation for temperature and pressure, and this means that the previous conversions apply to gas at any value of temperature and pressure.

Although inverse relativity is a new model that has not been tested yet, theoretically we can say that inverse relativity outperformed special relativity in solving both the Lorentz volumes paradox and the energy and time paradox, and thus also in merging with thermodynamics and establishing only one model for relativistic thermodynamics.

Inverse relativity depends mainly on vector analysis, which makes it more of a mathematical geometric model than a physical one, but the success of inverse relativity in establishing only one model for thermodynamics shows us the importance of vector analysis in this model, which reveals to us the energy and momentum transformations that are related with causality and thermodynamic phenomena, energy and momentum transformations that separate from causality and thermodynamics

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References

[1] Albert Einstein (2001). Relativity: The Special and the General Theory (Reprint of 1920 translation by Robert W. Lawson), p. 5, 14, 36

[2] R.C. Tolman (1934), Relativity, Thermodynamics, and Cosmology, Oxford: Clarendon Press, Reissued (1987), New York: Dover, p. 18, 136

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

[7] Three Views of a Secret in Relativistic Thermodynamics, Tadas K. Nakamura, Fukui Prefectural University, Fukui 910-1195, Japan