Relativistic Thermodynamics Laws According to Inverse Relativity

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ABSTRACT: The three laws of relativistic thermodynamics according to the inverse theory of relativity, the relativistic formula of the first law, we find that time dilation reduces all energy forms of the thermodynamic system from positive space without violating the principle of energy conservation. Where the loss in internal energy besides the work done on the mass of the system appears in the negative space, in the relativistic formula of the second law we get a stability value for the entropy of the system in the positive space and we also get an entropy similar to it in the negative space as a result of a modified copy of the microscopic information of the system, As for the relativistic formula of the third law, the value of entropy in positive space reaches zero when the temperature of the system reaches absolute zero, and in negative space the entropy also reaches zero when the speed of the reference frame theoretically reaches the speed of light.

Keywords: Relativistic Thermodynamics - Energy and time Paradox - Inverse Relativity - Entropy of negative space - Relativistic Heat - Relativistic Internal energy - Lorentz volumes paradox - Michael Girgis paradoxes

1 INTRODUCTION

In the seventh paper, entitled "Transformations of Relativistic Thermodynamics According to Inverse Relativity," we explained the success of the inverse theory of relativity as a new physical model in merging with thermodynamics, where only one model of relativistic thermodynamics was obtained, Which special relativity failed to achieve [7], so inverse relativity became the alternative model for special relativity [1] to establish relativistic thermodynamics, However, The seventh paper was restricted to transformations of both volume and pressure and temperature of the gas in the thermodynamic system, so we will complete here the attempt to combine inverse relativity and thermodynamics in order to obtain the relativistic formulas of the three laws of thermodynamics, Where obtaining the relativistic formula of the first law requires obtaining the transformations of all forms of energy possessed by a thermodynamic system, and obtaining the relativistic formula of the second and third law on entropy transformations, Will the first law transformations according to inverse relativity be compatible with the nature of the first law as the law of conservation of energy?, Will the transformations of the second and third law also be consistent with the nature of entropy as a measure of disorder in microscopic information? In other words, will the transformations of different forms of energy and entropy according to inverse relativity conserve energy and information in a thermodynamic system when converting from one frame of reference to another? Or will these transformations violate both energy and information conservation!

2 METHODS

2-1 The thermodynamic System within Reference Frames

We assume that we have two reference frames S and S' [1] 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 [3] of a monatomic ideal gas, as shown in the following figure, it is the same system used in the seventh paper [6]

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

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

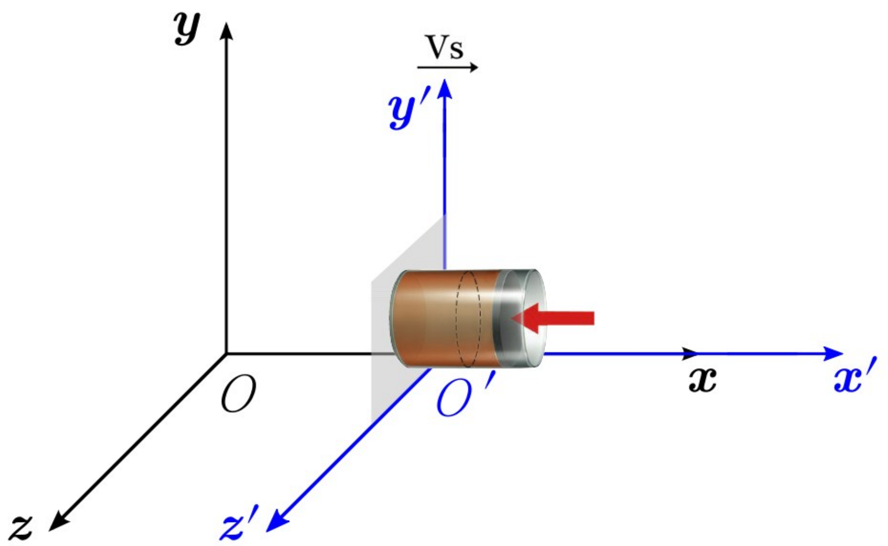

Figure 1:6

2-2 Relativistic Formula of the First law of Thermodynamics

The first law in thermodynamics [2], as we know, is the law of energy conservation in the thermodynamic system, as it includes forms of energy that can be added or lost from the system, such as heat, mechanical work by piston, and the change in the internal energy of the system resulting from those forms, so the relativistic formula of this law represents transformations all previous forms while conserving energy

Transformation of Internal Energy

The internal energy [3] of a thermodynamic system is the sum of the energies contained in the system's particles such as kinetic energy, potential energy, chemical bonding energy, etc. But in thermodynamics, according to the kinetic theory of gases, the concept of internal energy as a macroscopic variable is limited to only one microscopic variable, which is the kinetic energy resulting from the motion of gas molecules, whether it is translational, rotational, or vibrational. That is, the internal energy of a thermodynamic system is sum of the kinetic energies (transitional, rotational, and vibrational) of the molecules of this system, and because we assume that the gas used in the system is a monoatomic gas, and therefore all of the rotational and vibrational kinetic energy are non-existent here, that is, the relation obtained by the observer is O' for reference frame S' between the internal energy and the translational kinetic energy of the molecules is as follows

$$\grave{U}_{\alpha_0} = \sum_{i=1}^{N} \left(K\grave{E}_{\alpha_0} \right)_i = N \; \overline{KE}`_{\alpha_0} \tag{1.8}$$

Where $\grave{U}_{\alpha_0}$ internal energy of the system, $\overline{KE}`_{\alpha_0}$ is the average translational kinetic energy of the molecule on the 3D displacement vector $\overrightarrow{\alpha`_0}$, Which is the most probable value of the kinetic energy of the molecules of a system in thermodynamic equilibrium according to Maxwell Boltzmann statistics, , N is the number of gas molecules, and using the same mathematical formula, the observer O obtains the relation between the internal energy and the translational kinetic energy of the molecule in the reference frame S, but in the second observation conditions or in the positive space according to the principle of inverse relativity explained in the third paper [5]

$$U_\beta = \sum_{i=1}^{N} \left(KE_\beta\right)_i = N\,\overline{KE}_\beta \tag{2.8}$$

where U_β is the internal energy of the system, and $\overline{KE}_\beta$ is the average translational kinetic energy of the molecule on the 3D displacement vector $\overrightarrow{\beta}$, so we conclude that the conversion of the internal energy of the thermodynamic system from one reference frame to another in the second observation conditions depends on the conversion of the average kinetic energy of the molecule from frame S' to frame S, which was previously obtained in the seventh paper, Equation No. 11.7 [6]

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

Where, γ is the Lorentz factor

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

Substitute from 11.7 into 2.8

$$U_\beta = N\ \overline{KE}`_{\alpha_0}\,\gamma^{-1} \tag{3.8}$$

Substitute from 1.8 into 3.8

$$U_\beta = U\grave{}_{\alpha_0}\,\gamma^{-1} \tag{4.8}$$

From the previous transformation equation we also obtain a transformation of an infinitesimal change in internal energy

$$dU_\beta = dU\grave{}_{\alpha_0}\,\gamma^{-1} \tag{5.8}$$

Transformation of Mechanical Work by Piston

In order to get the transformation of mechanical work [3], we assume here that the piston moves an infinitesimal distance inward in a thermodynamic process, and thus we get here mechanical work done on the gas observed by the observer O' relative to the reference frame S', according to the following law

$$\delta W\grave{}_{\alpha_0} = P\grave{}_{\alpha_0}\,dV\grave{}_{\alpha_0} \tag{6.8}$$

Where $\delta W\grave{}_{\alpha_0}$ is the amount of mechanical work which is a path function, $P\grave{}_{\alpha_0}$ the gas pressure on the piston, $dV\grave{}_{\alpha_0}$ an infinitesimal change in volume as a result of moving the piston, using the same mathematical formula, the observer O obtains the mechanical work in the reference frame S, but in the second observation conditions or in the positive space

$$\delta W_\beta = P_\beta \, dV_\beta \tag{7.8}$$

From the seventh paper, Equations No. 4.7 and 21.7, we obtain the conversion of both volume and pressure in the second observation conditions or according to inverse relativity [6]

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

From which we obtain the infinitesimal transformation in volume

$$dV_\beta = dV\grave{}_{\alpha_0} \tag{8.8}$$

$$P_\beta = P\grave{}_{\alpha_0} \, \gamma^{-1} \tag{21.7}$$

Substitute from 8.8, 21.7 into 7.8

$$\delta W_\beta = P\grave{}_{\alpha_0} \, dV\grave{}_{\alpha_0} \, \gamma^{-1} \tag{9.8}$$

$$\delta W_\beta = \delta W\grave{}_{\alpha_0} \, \gamma^{-1} \tag{10.8}$$

Transformation of Heat

As for the transformation of the amount of heat [3] that the system gains or loses when transitioning from one state to another in a thermodynamic process, it is observed by the observer O' relative to the reference frame S' through the first law [2] in thermodynamics, and it is also a path function, so it is written in the following differential form

$$dU\grave{}_{\alpha_0} = \delta Q\grave{}_{\alpha_0} - \delta W\grave{}_{\alpha_0} \tag{11.8}$$

$$\delta Q\grave{}_{\alpha_0} = dU\grave{}_{\alpha_0} + \delta W\grave{}_{\alpha_0} \tag{12.8}$$

Using the same mathematical formula according to the principle of inverse relativity, and by substituting from the conversion equations for the change in internal energy and mechanical work by the piston, we get the following equation

$$\delta Q_\beta = \delta Q\grave{}_{\alpha_0} \, \gamma^{-1} \tag{13.8}$$

From equations 13.8, 10.8, 4.8, we find that both the heat and the work done by the piston or the change in the internal energy resulting from both of them decrease in the second observation conditions in the reference frame S with the increase in the speed of the reference frame Vs, In other words, time dilation reduces all forms of energy in the system from positive space., and we can express that in only one formula, by substituting from 11.8 into 5.8

$$dU_{\beta} = \frac{1}{\gamma}\left(\delta Q^{`}_{\alpha_0} - \delta W^{`}_{\alpha_0}\right) \tag{14.8}$$

Equation 14.8 represents the relativistic formula for the first law in thermodynamics. The results of this formula may seem contradictory to the nature of the first law in thermodynamics because it is the law of conservation of energy as we mentioned above, but according to inverse relativity, when the kinetic energy of a particle on the vector $\vec{\beta}$ decreases, (vector of positive space) moves to the vector $\vec{\varphi}$ (vector of negative space), so the system has an internal energy in negative space, which is equal to the sum of the kinetic energies of the particles of the system on vectors $\vec{\varphi}$ in negative space

$$U_{\varphi} = \sum_{i=1}^{N}\left(KE_{\varphi}\right)_{i} \tag{15.8}$$

From the third paper, Equation No. 52.3, we obtain the conversion of kinetic energy from the vector $\overrightarrow{\alpha^{`}_{0}}$ to the vector $\vec{\varphi}$ [5]

$$KE_{\varphi} = KE^{`}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{52.3}$$

Substitute from 52.3 into 15.8

$$U_{\varphi} = \sum_{i=1}^{N}\left(KE^{`}_{\alpha_0}\right)_{i}\left(\gamma - \frac{1}{\gamma}\right) \tag{16.8}$$

Substitute from 1.8 into 16.8

$$U_{\varphi} = U^{`}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{17.8}$$

From the previous transformation equation we also obtain the transformation of an infinitesimal change in the internal energy

$$dU_{\varphi} = dU^{`}_{\alpha_0}\left(\gamma - \frac{1}{\gamma}\right) \tag{18.8}$$

Equation 17.8 shows that the negative internal energy of the system increases in the reference frame S with the increase in the velocity of the reference frame Vs, due to the increase in the mass of the particles or the work done for the movement of the system with the reference frame, and therefore when adding the positive and negative internal energy of the system we find that the amount of internal energy relative to the frame the reference S is greater than the internal energy relative to the reference frame S', and this means that the amount of internal energy of the system at rest and the work done for the movement of the system remains also preserved for the reference frame S

$$U_\beta + U_\varphi = \grave{U}_{\alpha_0}\, \gamma \tag{19.8}$$

The previous equation can be written in the following form

$$U_\beta + U_\varphi = \grave{U}_{\alpha_0} + \grave{U}_{\alpha_0}(\gamma - 1) \tag{20.8}$$

We find here that the amount $\grave{U}_{\alpha_0}(\gamma - 1)$ corresponds to the formula for the relativistic work done for the movement of the system, but $\grave{U}_{\alpha_0}$ here does not represent the sum of the total energy of the particles of the system, so this amount represents part of the relativistic work for the movement of the system, or in other words It is the work done on a mass equivalent to internal energy, so we can write the equation in the following form [1]

$$U_\beta + U_\varphi = \grave{U}_{\alpha_0} + \Delta W_s \tag{21.8}$$

As for the amount of heat and work by the piston, there are no transformations in negative space, or in other words, an increase in negative space, because these forms are conserved within the thermodynamic system as an increase or decrease in the internal energy of the system

2-3 Relativistic Formula of The second Law of Thermodynamics

The Entropy of The System in Positive Space

When the thermodynamic system moves from the state 1 to state 2, regardless of the type of process or path (reversibly or irreversibly), the entropy of the system changes, as the observer O' observes the change in the entropy of the system relative to the frame of reference S' through the second law of thermodynamics [2]

$$\Delta S\grave{}_{\alpha_0} = \int_1^2 \frac{\delta Q\grave{}_{\alpha_0}}{T\grave{}_{\alpha_0}} \tag{22.8}$$

where $\Delta S\grave{}_{\alpha_0}$ is a change in the entropy of the system, we use here the general formula of the second law of thermodynamics, because the integral of the magnitude $\delta Q\grave{}_{\alpha_0}/T\grave{}_{\alpha_0}$ depends on the type of thermodynamic process or path followed in the system, and using the same mathematical formula, the observer O obtains the entropy change of the system in the reference frame S, but in the second observation conditions or in the positive space

$$\Delta S_\beta = \int_1^2 \frac{\delta Q_\beta}{T_\beta} \tag{23.8}$$

From the seventh paper, Equation 13.7, we obtain the temperature transformation in the second observation conditions or according to inverse relativity [6]

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

Substitute from 13.7, 13.8 into 23.8

$$\Delta S_\beta = \int_1^2 \frac{dQ\grave{}_{\alpha_0}}{T\grave{}_{\alpha_0}} \frac{\gamma^{-1}}{\gamma^{-1}} \tag{24.8}$$

Substitute from 22.8 into 24.8

$$\Delta S_\beta = \left(\frac{\gamma^{-1}}{\gamma^{-1}}\right) \Delta S\grave{}_{\alpha_0} \tag{25.8}$$

If the speed of the reference frame Vs is less than the speed of light, then the magnitude inside the arc is always equal to one and the equation becomes in the following form

$$\Delta S_\beta = \Delta S\grave{}_{\alpha_0} \qquad S_\beta = S\grave{}_{\alpha_0} \qquad V_S < c \tag{26.8}$$

We can also write the equation in the following form

$$\Delta S_\beta = \int_1^2 \frac{\delta Q\grave{}_{\alpha_0}}{T\grave{}_{\alpha_0}} \geq 0 \qquad V_S < c \tag{27.8}$$

Equation 27.8 represents the relativistic formula for the second law in thermodynamics, and it shows that the amount of change in entropy or the value of absolute entropy is constant in the second observation conditions, when the velocity of the reference frame Vs is less than the speed of light, and this means that all physical and chemical processes that occur spontaneously in the reference frame S', it also remains spontaneous in the second observation conditions or in positive space, but when the velocity of the reference frame theoretically reaches the speed of light, by substituting for this into Lorentz factor in equation 25.8

$$\Delta S_\beta = \frac{0}{0} \qquad\qquad S_\beta = \frac{0}{0} \qquad\qquad V_S = c \qquad\qquad (28.8)$$

The amount of change in entropy or the absolute value of entropy in positive space is an unknown quantity. This does not represent a collapse in Equation 25.8, because entropy is a measure of the disorder in the microscopic information of the system. When V_S reaches the speed of light, time expands to infinity and both energy and matter are reduced or lost as well (because the mass decreases in the second observation conditions with the increase of V_S) from the positive space, and thus all information disappears at the microscopic and macroscopic level as well. In this case, there is no meaning of entropy in the positive space because there is no information. The disappearance of information from the positive space does not mean that Inverse relativity violates the principle of conservation of information at the speed of light because inverse relativity does not deal with a single space

The Entropy of the System in Negative Space

In the previous item, we were able to observe the change in the entropy of the system relative to the reference frame S' through macroscopic variables such as the amount of heat, temperature, or volume and pressure when integrating equation 22.8, and thus we were able to obtain the entropy transformation in the second observation conditions or in the positive space

But in negative space, we do not have volume, As negative space consists of only one spatial dimension according to the modified Lorentz transformations, the second paper [4], and there is no pressure for gas because the momentum of the particles on the vector $\overrightarrow{\varphi}$ is negative momentum that does not produce pressure, and there is also no concept of temperature because the negative energy does not exchange between the particles of the system, we explained all this in the seventh paper [6], Thus, it will seem to us that the system does not have entropy in negative space, but according to Kinetic theory of gases and statistical mechanics, the entropy at the microscopic level is a measure the amount of randomness in the system's microscopic information, where we find entropy as a macroscopic variable for the system that depends on the number of possible microscopic states of the system according to the Boltzmann equation [3].

$$S^{`}_{\alpha_0} = K \ln \Omega^{`}_{\alpha_0} \left(U^{`}_{\alpha_0} \right) \quad (29.8)$$

Where $\Omega^{`}_{\alpha_0}$ is the number of microscopic states that achieve the same macroscopic state as $U^{`}_{\alpha_0}$ of the system, K is Boltzmann's constant

From the equation for converting the 4D vector $\overrightarrow{\alpha`_0}$ to the 4D vector $\overrightarrow{\varphi}$ in the second paper, Equation 60.2 [4], with the assumption that $V^{`}_{\alpha_0}$, V_S in the equation is constant We find that any change in the position of the particle (molecule) in the observer's space O' (reference frame S') also corresponds to a change in the position of the particle in the negative space. Therefore, the order of the positions of the particles in a possible microscopic state of the system in the observer space O' is also corresponds to the order of the positions of the particles in the negative space, i.e. corresponds to a potential microscopic state in the negative space

$$x_\varphi^2 - V_S^2\, t_\varphi^2 = x`^2_{\alpha_0} + y`^2_{\alpha_0} + z`^2_{\alpha_0} - V`^2_{\alpha_0}\, t`^2_{\alpha_0} \quad (60.2)$$

$$dx_\varphi^2 - V_S^2\, dt_\varphi^2 = dx`^2_{\alpha_0} + dy`^2_{\alpha_0} + dz`^2_{\alpha_0} - V`^2_{\alpha_0} dt`^2_{\alpha_0} \quad (30.8)$$

From the kinetic energy transformation equation from the vector $\overrightarrow{\alpha`_0}$ to the vector $\overrightarrow{\varphi}$ in the third paper Equation 52.3, we find that the kinetic energy $KE_\varphi$ is directly proportional to the kinetic energy $KE^{`}_{\alpha_0}$ This means that any change in the kinetic energy of the particle in the observer's space, O', also corresponds to a change in the kinetic energy in the negative space, although the particle has a constant velocity in this space, and therefore the different values of the kinetic energy of the particles in a possible microscopic state of the system also correspond to it different values of the kinetic energy of particles in negative space, i.e. corresponds to a potential microscopic state in negative space

$$dKE_\varphi = dKE^{`}_{\alpha_0} \left(\gamma - \frac{1}{\gamma} \right) \quad (31.8)$$

We conclude from the above that the number of possible microscopic states $\Omega^{`}_{\alpha_0}$ of the system in thermodynamic equilibrium relative to the reference frame S' that achieve the macroscopic state $U^{`}_{\alpha_0}$, is equal to the number of possible microscopic states of the system Ω_φ in the negative space, which achieves the same macroscopic state U_φ but in negative space

$$\Omega_\varphi = \Omega^{`}_{\alpha_0} \quad (32.8)$$

Thus, we have entropy in negative space S_{φ} and a value is determined by the Boltzmann equation

$$S_{\varphi} = K \ln \Omega_{\varphi} \tag{33.8}$$

Substitute from 32.8, 29.8 into 33.8

$$S_{\varphi} = \grave{S}_{\alpha_0} \tag{34.8}$$

And by following the same previous steps with the transformation equations of total energy, mass and momentum, we arrive at that the change in total energy, mass and momentum besides the position and kinetic energy in the observer space O' also corresponds to a change in the negative space, and this means that the negative space has a modified copy of the microscopic information of the system and entropy this space is disorder or randomness in the microscopic information modified, therefore, when all the thermodynamic information of the system at the microscopic and macroscopic level theoretically disappears in the positive space as we mentioned above, we find here that the microscopic information of the system also remains conserved in the negative space

2-4 Relativistic Formula of the Third Law of Thermodynamics

According to the third law of thermodynamics [2], When the absolute temperature of the thermodynamic system theoretically reaches absolute zero, because we can't reach it practically, the value of the entropy of the system observed by the observer O' with relative to the frame of reference S' is also zero, and is written in the following formula

$$\left(\grave{S}_{\alpha_0} \right)_{\grave{T}_{\alpha_0} = 0K} = 0 \tag{35.8}$$

Where $\grave{S}_{\alpha_0}$ is the absolute entropy of the system, $\grave{T}_{\alpha_0}$ is the absolute temperature, 0K is zero Kelvin or absolute zero, and using the same mathematical formula, the observer obtains O the value of the absolute entropy of the system relative to the frame of reference S, but in the second observation conditions or in the positive space, i.e. according to inverse relativity

$$\left(S_{\beta} \right)_{T_{\beta} = 0K} = 0 \tag{36.8}$$

We conclude from equations 35.8 and 36.8 that in this case $T_\beta = \grave{T}_{\alpha_0}$ and therefore we can write the previous equation in the following formula

$$(S_\beta)_{\grave{T}_{\alpha_0} = 0K} = 0 \qquad\qquad V_S < c \qquad\qquad (37.8)$$

Equation 37.8 represents the relativistic formula of the third law in thermodynamics, and it shows that the value of the absolute entropy of a thermodynamic system in positive space reaches zero when the temperature of the system in the observer's space O' reaches absolute zero, and this result agrees with the transformation equations for both entropy and temperature , but when the velocity of the frame of reference theoretically reaches the speed of light, the value of entropy becomes unknown as we have previously explained above, Thus, the importance of the entropy of negative space appears here, written in the following form

$$(S_\varphi)_{V_S = c} = 0 \qquad\qquad \grave{T}_{\alpha_0} = 0K \qquad\qquad (38.8)$$

And we can generalize equation 38.8 at any temperature of the system, because when the velocity of the reference frame reaches the speed of light, all energy and matter move from the positive space (the causal space), to the negative space (the non-causal space), and therefore there is no collision between the gas molecules, and therefore also there is no change in the kinetic energy and the position of each particle That is, the gas molecules have fixed kinetic energy values and positions, and thus the system has only one microscopic state. By substituting for that in equation 33.8, we get the same result as equation 38.8

$$V_S = c \qquad\qquad \Omega_\varphi = 1 \qquad\qquad S_\varphi = 0 \qquad\qquad (39.8)$$

We conclude from this that the effect of the speed of light on the entropy of the system is similar to the effect of absolute zero on the entropy of the system, but from the theoretical side only, because it is not possible to reach the speed of light or absolute zero from the practical side

Comparison tables between the relativistic formulas of the laws of thermodynamics in positive and negative space according to inverse relativity

Laws of Thermodynamics	Positive Space	Negative Space
The First Law	$dU_\beta = \frac{1}{\gamma}\left(\delta Q_{\alpha_0}^{`} - \delta W_{\alpha_0}^{`}\right)$	$dU_\varphi = dU_{\alpha_0}^{`}\left(\gamma - \frac{1}{\gamma}\right)$
The Second Law	$\Delta S_\beta = \int_1^2 \frac{\delta Q_{\alpha_0}^{`}}{T_{\alpha_0}^{`}} \geq 0 \qquad V_S < c$	$S_\varphi = K \ln \Omega_{\alpha_0}^{`}$
The Third Law	$\left(S_\beta\right)_{T_{\alpha_0}^{`} = 0K^\circ} = 0 \qquad V_S < c$	$\left(S_\varphi\right)_{V_S = c} = 0$

3 RESULTS

When combining inverse relativity with thermodynamics to obtain the relativistic formulas for the three laws of thermodynamics, in the relativistic formula of the first law, we find that time dilation reduces the internal energy of the thermodynamic system when converting from one frame of reference to another in the second observation conditions (inverse relativity) or in positive space, Thus, both the amount of heat and the mechanical work by the piston added or lost from the system are also reduced because it is just a change in the internal energy of the system, that is, All forms of energy in the system are reduced from the positive space, but without violating the principle of energy conservation, Where we find that the decrease in the internal energy, in addition to the mechanical work done on the mass of the system for movement with the frame of reference, appears in negative space as negative energy, the relativistic formula of the second law, We obtain a constant value for the entropy of the system when converting from one reference frame to another in the second observation conditions or in the positive space, but when the velocity of the reference frame theoretically reaches the speed of light, the entropy value becomes undefined as a result of the reduction of all energy and matter from the positive space and thus information microscopic system, and this does not represent a violation of the principle of conservation of information, Where we get an entropy similar to the entropy of the system as a result of the existence of a modified copy of the microscopic information of the system in negative space, The relativistic formula of the third law, we find that the entropy of the system in positive space reaches zero when the temperature of the system in the reference frame reaches absolute zero, and in negative space it also reaches zero when the velocity of the reference frame reaches theoretically the speed of light, whether the temperature of the system is equal to absolute zero or not equal.

4 DISUSSIONS

The internal energy transformations depended on the classical concept of the internal energy of the thermodynamic system, which is the sum of the kinetic energies of only the ideal gas particles in the system. As a result, we lost part of the work done on the mass of the system in equation 23.8, Therefore, it is better to create a relativistic concept of the internal energy of the system, where the internal energy is the sum of the total energies [1] (rest mass energy and kinetic energy together) of the particles of the system, and by following the same previous steps in the internal energy transformations and as a result of the symmetry of the conversion equations of total energy and kinetic energy in inverse relativity We reach the same previous equation, but here we see the amount of total work done on the mass of the system, and therefore we can say here that the inverse theory of relativity is a theory that conserves energy.

$$U_\beta + U_\varphi = \grave{U}_{\alpha_0} + W_s \tag{39.8}$$

According to the inverse relativistic transformations in the negative space, we find that the negative space does not contain the macroscopic information of the thermodynamic system such as volume, pressure, temperature, heat, and mechanical work by the piston. But this does not represent a loss of macroscopic information because this information is basically the result of a statistical process of the microscopic information present in the negative space, and therefore it is also preserved in negative space not as real variables but as information. Therefore, we can say here that the inverse theory of relativity is a theory that preserves macroscopic and microscopic information of a thermodynamic system even when the system reaches the speed of light or infinite time dilation

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