

Relativistic Effect of Non Rigid in Motion: Volume Contraction in All Directions; Space Around It Warped

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Abstract

Ignoring the internal structure of moving objects and treating them as rigid bodies is not only out of practice but also inconsistent with the spirit of scientific exploration. To change this status quo, consider the relativistic effects of real object motion. Consider the mass-velocity relationship as an initial mechanism to discuss the effect of velocity on the space around an object and on the volume of the object. The relativistic mass-velocity relationship and the relationship between atomic radius and mass together constitute one of the physical mechanisms for the volume contraction of objects due to motion. A series of new conclusions are obtained, such as: the space distortion of a moving system with mass due to inertial motion at ultra-high speed, and even the generation of neutron like stars or black holes; the 3D contraction of objects due to motion; Because the empty space can neither bear nor exert force, in terms of mechanical performance, space and object are always independent of each other, and space cannot move (at most, its motion can only be set subjectively); Even maintaining inertial motion does not guarantee that space is flat, and special relativity can only be approximated at best. It shakes the position of the theoretical criterion of "covariance under Lorentz transformation". It lays a solid foundation for transforming the view of relative space-time into the view of relative absolute space-time and giving birth to the theory of relative absolute.

Keywords

Theory of relativity, Rigid bodies, Inertial motion, Mass-velocity relation, 3D relativistic contraction, Moving mass black hole, Curved space, Flat space.

1. Introduction

The consequences of the clock's high-speed motion (even faster than the speed of light) have been discussed by many ^[1]. However, how the space around the object changes in the case of ultra-high-speed inertial motion is hardly discussed. Variations in the volume of moving non-rigid bodies are also ignored. The author of this paper and some colleagues have done a lot of work criticizing the special theory of relativity (mainly criticizing the principle of special relativity) ^[2-15]. The special theory of relativity has always only discussed the relativistic effect of the motion factor by treating the moving object as a rigid body. However, actual objects are not rigid bodies, and the pursuit of relativity is precise mechanical performance, so it is not appropriate to treat objects as approximate rigid bodies. Reference ^[17] has improved this situation, but it is not thorough enough. This paper will introduce the mechanisms and results of the three-dimensional contraction and four-dimensional spatiotemporal changes of mass systems due to high-speed motion. These two important results are obtained by not treating a moving body as a rigid body and considering the relativistic mass velocity relationship. Among them, the conclusion that "even if only inertial motion can not guarantee the flatness of space-time" is enlightening. For the achievements of criticizing the theory of relativity and quantum mechanics, many scholars have formed aesthetic fatigue, so they don't pay much attention to the remarks of criticizing the pillar theory ^[20]. The new relativistic effect introduced in this paper not only directly increases human knowledge, but also

exposes the contradictions of special relativity (the space distortion around a moving object is deduced from the mass-velocity relationship of special relativity, breaking the conditions under which special relativity applies). It is hoped that readers will be interested in the conclusions of this article so as to eliminate aesthetic fatigue.

The establishment and promotion process of the special theory of relativity is as follows. The first is to propose the principle of relativity and the principle of constant speed of light (as the basic premise of the theory). The second is to derive the Lorentz transform. Then there are some conclusions and inferences based on the basic premises and the Lorentz transformation. Next is the application and experimental verification. In the process of applying, explaining and verifying the special theory of relativity with experimental methods, there are many default assumptions and viewpoints. These default assumptions and viewpoints mainly include the following. We believe that many also feel that the more they look, the more they feel that these defaults are unreliable (insufficient basis). But without them, the application of special relativity would be impossible. However, these defaults are not derived from practice, but are subjectively conjectured for the needs of explaining and applying the theory of relativity. Their role until now is to obscure (or hide) the problems of special relativity. While they can obscure (or hide) the problems of special relativity, they have serious problems of their own, just very hidden. This is a problem relay phenomenon and one of the methods of sophistry. In addition to two basic assumptions, the default arguments of special relativity are: The mathematical coordinates in the Lorentz transformation are the real space-time coordinates; A space for movement can be created artificially; Space shrinks due to motion, causing the length (or volume) of objects embedded in space to shrink due to motion.

2. The Physical Mechanism by Which the Volume of a Non-rigid Body Shrinks in All Directions Due to Motion

The relativistic mass-velocity relationship is

$$m = \gamma m_0 . \quad (1)$$

Here, $\gamma = 1/\sqrt{1-(v/c)^2}$. There are various derivation methods for **Eq. (1)**, which are not exclusively derived from the theory of relativity^[18-21]. Special relativity ignores the internal composition and structure of moving objects and treats it as a quasi-rigid body, and admits that objects traveling very close to the speed of light will shrink into very thin panels. The reason for this change is also believed to be the "contraction of space due to motion" causing the objects embedded in it to contract. However, from **Eq. (1)** and general relativity, it is easy to see that when an object moves very close to the speed of light, it can become a spherical black hole, and the space around the object is also will bend badly (we will calculate this speed limit in **Section 2.3**, and the speed greater than this value but less than the speed of light is called super high speed). This means that the space around the mass carrier is bent by the movement of the mass carrier. When the space is curved, the volume of the moving object shrinks, not only in the direction of motion, but also in other directions, and the multiple of shrinkage is not always $\sqrt{1-(v/c)^2}$ times (the volume of a moving object shrinks, but the space just bends instead of shrinking). This conclusion, which takes into account the mass-velocity relationship of special relativity and the general theory of relativity, is in serious conflict with the special theory of relativity that "space contracts in a single stretching direction due to motion". Previously, the way to avoid this contradiction was to ignore the internal composition and structure of moving objects (obviously ignoring the mass-velocity relationship too), or to ignore general relativity effects of particles inside moving objects (*i.e.*, ignoring gravitational interactions inside moving objects). However, for the discussion of changes in moving objects, there is an overlap between the scope of application of general relativity and that of special relativity. In addition, the set condition is that the mass carrier has ultra high speed motion within the framework of special relativity. In this overlapping area of application, the relativistic effect of 3D velocity still exists even if the concept of 4D velocities is used.

As mentioned above, for the volume of the object describing the motion to shrink due to the motion, the conclusion of the special theory of relativity contradicts the effect of the general theory of relativity obtained using **Eq. (1)**. This contradiction cannot be completely resolved by dividing the speed range and taking an approximation. The Lorentz transformation is widely used by special relativity. Its popular form is as follows:

$$dx = \frac{dx' + v dt'}{\sqrt{1 - v^2/c^2}}, dy = dy', dz = dz', dt = \frac{dt' + \frac{v}{c^2} dx'}{\sqrt{1 - v^2/c^2}} . \quad (2)$$

According to it, the expression for the contraction of the ruler moving in the X-axis direction due to the movement is as follows:

$$\left. \begin{aligned} dx' &= dx\sqrt{1-(v/c)^2} \\ dy' &= dy \\ dz' &= dz \end{aligned} \right\}. \quad (3)$$

The moving ruler does not contract in the Y -axis and Z -axis directions perpendicular to the velocity^[1]. For convenience, we call the contraction expressed by **Eq. (3)** "derived from the Lorentz transformation" as the Lorentz contraction (or one-dimensional relativistic contraction or Lorentz length-contraction). If a box is moving, Lorentz contraction means that one side of the box is shortened. Let $dx dy dz = dV_0$, $dx' dy' dz' = dV$, the Lorentz volume-shrinkage formula obtained from **Eq. (3)** is: $dV = dV_0 \sqrt{1-(v/c)^2} = \gamma^{-1} dV_0$. Under certain circumstances, the definite integral of this formula can be obtained (the integral range is from the origin to the finite value), turn out:

$$V = V_0 \sqrt{1-(v/c)^2} = \gamma^{-1} V_0. \quad (4)$$

Equation (3) or **Eq. (4)** is obviously a 1D contraction-formula of space. They are completely a mathematical result, and the expressed contraction has no specific physical mechanism (movement is only the theoretical cause of contraction rather than a specific physical mechanism). Einstein seems to have no subjective desire to discuss this physical mechanism (the characteristics of the theory also determine that he cannot discuss it). On the premise of not exploring the physical mechanism of space contraction, the special theory of relativity simply treats moving objects as non-deform-able rigid bodies without internal composition and structure. Only in this way can the contraction of the moving object in the direction of movement be attributed to the contraction of space due to the movement (that is, the difference between the three-dimensional contraction of object volume and the one-dimensional contraction of space is erased). However, the relativistic effect of particles inside an object has a clear physical mechanism. Can it be ignored? After reading the discussion about the influencing factors of the volume of moving objects below, we can judge correctly.

2.1. Conservation of orbital angular momentum

The arguments here leave traces of the old quantum theory. The Bohr model of the hydrogen atom in the old quantum theory is partially compatible with modern quantum mechanics. In addition, using Bohr's planetary model makes it easier to understand the physical mechanism of how objects contract due to motion. The key is that the old quantum theory is a better excess theory. As a transition, Bohr model can be used.

When the ground state hydrogen atom moves, the mass m of 1s electron increases according to the law of **Eq. (1)**. The orbital angular momentum of Bohr hydrogen atom is expressed as

$$\vec{L} = m \times \vec{u} \times \vec{r}. \quad (5)$$

For the ground state hydrogen atom, according to the planetary model, we have

$$\frac{Ze^2}{4\pi\epsilon_0 r^2} = \frac{u^2}{r} m. \quad (6)$$

Here, Z is the effective nuclear charge, and u is the electron orbital velocity. Substituting the scalar form of **Eq. (5)** with $mur = \hbar$ into **Eq. (6)**, we can obtain

$$u = Z\alpha c. \quad (7)$$

Here, α is the fine structure constant, and its value is about 1/137. **Equation (7)** and its derivation process show that when the mass of the electron is changed by the overall motion of the hydrogen atom, the speed of the planetary motion of the electron remains unchanged. As long as the orbital angular momentum of the 1s electron is conserved, when the electron mass m increases, the orbit radius r becomes smaller. Comparing three **Eqs (1)** and **(7)** and $mur = \hbar$, we have **Eq. (8)**.

$$r = \frac{\hbar}{mu} = \frac{\hbar \sqrt{1-(v/c)^2}}{m_0 v}. \quad (8)$$

Here, v — the velocity of the hydrogen atom, L — the orbital angular momentum of the hydrogen atom and m_0 — the mass of the electrons in the static hydrogen atom, m — the electron mass with an overall motion on the basis of the electron dynamic mass in the hydrogen atom. Different states of electron mass can be distinguished by adding

subscripts: m_e is the mass of the stationary electron, m_0 is the mass of the electron in the stationary hydrogen atom, and m is the mass of the electron in the moving hydrogen atom. If you seek more accuracy, you can use the reduced mass of electrons.

Using the solution of the Schrödinger equation, the more reliable conclusion that "the radius of the moving hydrogen atom decreases" can be obtained. In quantum mechanics, the size of an atom is a constant of its radius. As the atomic radius shrinks, the atomic volume shrinks in three dimensions.

2.2. The Mass-velocity Relationship and the Solution of the Schrödinger Equation Together Determine that the Radius of the Hydrogen Atom Decreases as the Electron Mass Increases

Solving the Schrodinger equation of hydrogen atom can get the Bohr radius expression of hydrogen atom.

$$r_{Bohr} = \frac{\epsilon_0 \hbar^2}{\pi m e^2}. \quad (9)$$

Comparing **Eqs (1) and (9)**, we can obtain

$$r_{Bohr} = \frac{\epsilon_0 \hbar^2}{\pi \gamma m_0 e^2} = \frac{\hbar \alpha}{\gamma m_0 c}. \quad (10)$$

It can be seen from **Eq. (10)** that when the hydrogen atom moves, the electron mass increases, the Bohr radius decreases, and the hydrogen atom shrinks in all directions. For the covalent molecule H_2 , the bond length of the chemical bond is also proportional to the Bohr radius or the size of the hydrogen atom. In this way, a hydrogen ruler composed of hydrogen molecules will also shrink in all directions due to motion. The expression for the relativistic contraction of the volumes of hydrogen atoms and molecules is as follows:

$$\left. \begin{aligned} r_x &= (r_x)_0 \sqrt{1 - (v/c)^2} \\ r_y &= (r_y)_0 \sqrt{1 - (v/c)^2} \\ r_z &= (r_z)_0 \sqrt{1 - (v/c)^2} \end{aligned} \right\}. \quad (11)$$

Here, r_i is the radii in the three mutually perpendicular directions of the moving hydrogen atom, and $(r_i)_0$ is the radii in the three mutually perpendicular directions of the stationary hydrogen atom. The volume of hydrogen atom $V = (4/3)\pi r^3$. Therefore, we have

$$V = V_0 \left[1 - (v/c)^2 \right]^{3/2}. \quad (12)$$

Here, V_0 is the volume of stationary hydrogen atoms or hydrogen molecules, and V is the volume of moving hydrogen atoms or hydrogen molecules. **Equation (12)** shows that the shrinkage of the volume of an object due to motion is not limited by the direction of motion. In the process of deriving **Eq. (12)**, the mass-velocity relation of special relativity and quantum mechanics effect are used but the gravitational effect is ignored. Under the condition that the speed is not particularly high, the general relativity effect is too weak to be ignored compared with the quantum mechanical effect. The Schrodinger equation utilized is a linear equation. Therefore, the shrinkage discussed in **Sections 2.1 and 2.2** is still a linear shrinkage of volume. **Equations (11) and (12)** express the three-dimensional shrinkage of the atomic volume. They are quantitative relationships between volume and velocity that are applicable within a certain range. Previously there was only a one-dimensional Lorentz contraction expression, generally called the length-velocity relationship. Previously only knowledge of Lorentz one-dimensional contractions (commonly called the length-velocity relationship) was known.

Some scholars think that **Eq. (12)** has already existed in textbooks without looking carefully. If you look carefully, it is not difficult to find that **Eq. (12)** is another representation of **Eq.(11)**, and **Eq. (11)** is not in the textbook. The formula in the textbook does not have the exponent 3 in **Eq. (12)**. Qualitatively, **Eq. (12)** describes the three-dimensional contraction law of the volume of moving objects. In textbooks, the one-dimensional Lorentz contraction formula first describes the law of pure space contraction, and then the one-dimensional Lorentz contraction can be compared with the subjective assumption that "objects are embedded in space, and space contraction causes objects to shrink synchronously" The volume of an object changes with movement. In conclusion, **Eqs (11) and (12)** are in competition with the one-dimensional Lorentz contraction formula (as the title of this article states, only one of the two descriptions is closer to the truth. The two should be identical in form, but fundamentally different in essence).

Equations (11) and (12) are only applicable to spaces filled with matter. For the coordinate frame (or pure space) without matter, there is no motion effect, which cannot be described by **Eqs (11) and (12)**, nor does it have the motion effect of time. The movement of the material system also has the effect of time movement. In this way, the motion of the matter system will be a four-dimensional space-time contraction (see Supplementary Material A for details).

For the covalent molecule H₂, the bond length of the chemical bond is also proportional to the Bohr radius or the size of the hydrogen atom. In this way, the hydrogen ruler composed of one hydrogen molecule will also shrink according to the law of **Eq. (12)** due to the movement (the speed of the Hydrogen ruler limited to close to the speed of light and not very close to the speed of light).

2.3. Space Bending Caused by Inertial Motion of An Object

It has been experimentally confirmed that the inertial mass of moving particles increases due to motion. Considering that the inertial mass is equal to the gravitational mass, we can be sure that the gravitational force of the moving particle will also increase due to the motion (space around particles can be distorted by motion). As the speed of the object increases, the mass of the particles inside it increases. The first effect that should not be ignored is that the gravitational force between particles in the object increases and the distance decreases (if the speed is lower than this, the interparticle attraction in the atom can be ignored). When the velocity increases again, the distortion of space-time caused by mass becomes more obvious, and even the atom and the object can collapse.

We discuss the quantitative bounds of these two effects using the example of a moving hydrogen atom. The velocity of the hydrogen atom required for the gravitational force between the nucleus and the electrons outside the nucleus to reach 1/100 the electromagnetic force can be calculated. The electrons in it have two levels of motion (except spin motion): Orbital motion of electrons (speed recorded as u); electrons move with the motion of hydrogen atoms (speed recorded as v). Since $u=Zac$, the difference between $m_e/\sqrt{1-(u/c)^2}$ and m_e is only 0.3/10000, and the relativistic effect of electron motion at this level can be ignored. According to this condition, we have

$$\frac{e^2}{4\pi\epsilon_0 r^2} = \frac{10GM_p m}{r^2}, \quad \frac{e^2}{4\pi\epsilon_0} \approx \frac{100Gm_p m_e}{1-(v/c)^2}. \quad (13)$$

Here, G is the gravitational constant, m_p is the stationary mass of the proton, $M_p = \gamma m_p$ is the mass of the proton in the moving hydrogen atom, m is the mass of the electron in the moving hydrogen atom, m_e is the mass of the stationary electron, and v is the movement speed of the hydrogen atom. Substitute the corresponding constant into **Eq. (13)**, we can obtain

$$\frac{v}{c} = \sqrt{1-0.66 \times 10^{-30}}. \quad (14)$$

This value is 0.999... 9 (there are 30 consecutive "9"). Speeds that reach or exceed this value can be called hyperspeed. When the speed of the hydrogen atom reaches this value, the gravitational force between the nucleus and the electron can obviously affect the size of the hydrogen atom, which should not be ignored (the change of the space-time curvature outside the nucleus should not be ignored). "The size of the hydrogen atom shrinks due to motion" caused by this relativistic effect will obviously deviate from **Eq. (12)**. The velocity expressed by **Eq. (14)** is the lower limit of the velocity of the gravitational force between particles inside the object that should not be ignored, and also the lower limit of the velocity that the space-time distortion effect should not be ignored.

Schwarzschild radius is $r_g = 2Gm/c^2$. It shows that the mass increases, the event horizon of the black hole increases, and the possibility of a finite mass object becoming a black hole increases. As the mass of each atom continues to increase, the moving object will be compressed to a small volume by gravity. As the horizon determined by the mass of matter within this small volume continues to grow, so that an occupied space containing the entire object can be reached. At this point, the object becomes a standard black hole (objects collapsed and deformed before reaching the density of a neutron star, and living things died long ago).

Considering the relativistic mass velocity relationship, as long as the velocity of a proton is high enough, its mass value can make it a small black hole. Let the Schwarzschild radius of the moving proton be the radius of the proton (about $10^{-15}m$), the moving mass of proton obtained by substituting relevant data into Schwarzschild radius formula is about 10^{38} kg, and the ratio of moving mass to static mass is

$$m_p/10^{38} = \sqrt{1-v^2/c^2}. \quad (15)$$

Take the quadratic power on both sides of the above formula, shift the term, and then take the square root of both sides, and you can get:

$$v/c \approx \sqrt{1 - 10 \times 10^{-76}} \quad (16)$$

This ratio is 0.999...9 (there are 76 consecutive "9"), *i.e.*, the v is very close to the speed of light. It is the lower limit of the velocity at which hydrogen atoms collapse due to motion. The situation is similar for other objects moving at high speed. Special relativity just doesn't allow objects to travel up to the speed of light. Therefore, the above very close to the speed of light is still within the allowable range of special relativity. It can be seen that moving rulers or rods or objects cannot be regarded as rigid bodies and ignore the relativistic effects of particles inside them. When the speed of motion of an object is very high, the contraction of its volume due to motion cannot be explained by the contraction of space due to motion.

The mass of one kilogram of matter increases due to motion to reach an event horizon radius of 0.1mm, and the required speed is $v/c = \sqrt{1 - 0.55 \times 10^{-46}}$. This ratio is about 0.999...9 (there are 46 consecutive "9"). This velocity value is the lower limit on the velocity at which the object collapses due to motion.

In this section, within the framework of the special theory of relativity, as the speed of the object increases, the gravitational interaction (the effect of general relativity) inside the object cannot be ignored. The gravitational effect mentioned here mainly refers to the collapse of the object caused by the ultra-high-speed motion of the object into a neutron star or a black hole, and the curvature of the space around the object. Gravitational contractions caused by objects moving at low speeds can generally be ignored. **Equation (12)** is the standard expression of the relativistic effect of a moving non-rigid body. **Equation (14)** shows that when the speed of hydrogen atom is less than that indicated by **Eq. (14)** (the gravitational force between particles inside the object is much smaller than the electromagnetic force), **Equation (12)** is applicable to atoms, molecules and dense metal substances. "The volume of other substances shrinks due to movement" will deviate from **Eq. (12)**. Although the discussion in this section does not give an expression for the shrinkage of an object due to the non-negligible gravitational force between particles inside, it has been clearly pointed out that such shrinkage exists through quantitative and qualitative analysis. It belongs to the general relativity effect induced by the inertial motion. The reason is that the relativistic effect that has the participation of gravity or the consequence of space-time distortion is the general relativistic effect, and it is a nonlinear relativistic effect. Although the initial inducements of the linear relativistic effects and nonlinear relativistic effects discussed in **Section 2** are inertial motions, these two contractions are independent of each other, and they have no logical relationship with the Lorentz contraction. From a qualitative point of view, the closer the speed of an object is to the speed of light, the greater the curvature of the space around the particles inside the object, and the object can even shrink to the extreme — turning into a neutron star structure or collapsing into a black hole.

Although both the special theory of relativity and the general theory of relativity use the changes of space-time to describe the effect of force, for describing specific high-speed moving objects with internal composition and structure, the effect produced by the physical mechanism of general relativity and the effect produced by the mechanism of special relativity are contradictory of: The mathematical conclusion that there is no specific mechanism in the special theory of relativity is that the moving ruler (or space) shrinks only in the direction of motion (1D contraction of space or volume. The space before and after shrinking is linear), and the object will not collapse due to motion; the effect of the mechanism of general relativity is that the inner and outer space of the moving ruler is curved (The contraction of the corresponding object due to motion is also inconsistent with the conclusion of special relativity — it is a three-dimensional contraction of space, and can collapse due to hypervelocity motion. At the same time, the linear space becomes a nonlinear space due to high-speed motion). The contraction mechanism revealed in this section shows that, for the consequences of the mass carrier motion, the speed ranges of "the special relativity 'mechanism' taking effect and the general relativity mechanism taking effect" are completely coincident. Taking approximations can stretch its applicability a bit, but not completely. For example, for hydrogen atoms and solid hydrogen to contract due to motion, the velocity interval where the special relativity effect and the general relativity effect are applicable together

is $(\overbrace{0.999 \dots 9}^{n=30}, c)$ (The reason is that, as far as the speed condition is concerned, as long as the speed is not greater than or equal to the speed of light, the theory of relativity applies). Can two types of relativistic effects acting on the same object be superimposed linearly? The gravitational contraction effect, the Lorentz contraction effect and the pure mass contraction effect cannot be superimposed linearly. In this common applicable range, there is a speed interval in which neither the general relativity effect nor the special relativity effect can be ignored. Another contradiction between special relativity and general relativity is that for an accelerating system, within the framework of general relativity there is one system, while within the framework of special relativity there are multiple systems. No matter how much approximation is taken, this contradiction cannot be eliminated.

From the description in this section, it can be seen that within the framework of relativity, considering the motion

of real non-rigid bodies, the following conclusions can be drawn. Observer A can observe: when the observer B is accelerated to a state of ultra-high-speed motion, B can become a black hole, and this process cannot be reversible (decelerates to a static state and cannot be restored to the original state), and the change in this process is absolute (not relative). That is, in this case of super-high-speed relative motion, at most one of A and B becomes a real black hole. The other is at best an apparent black hole (*i.e.* a non-real black hole). This shows that the relativistic effect caused by the motion can only be superficial (we can only choose one between the reality of the relativistic effect and the special principle of relativity). It can be seen that the special principle of relativity is threatened ("when observing each other, the two sides being observed will undergo relativistic changes at the same time" is not true). The conclusion that "the inertial motion of a real object can also bend the space around the object" leads to the conclusion that "even if all the original conclusions and inferences of special relativity are tenable, special relativity can only be an approximate theory, and the higher the speed, the higher the degree of approximation".

2.4. Influence of van der Waals Forces

In the case of a ruler made of solid hydrogen, it contracts due to motion, involving changes in the distances between molecules. The van der Waals force between molecules is still an electromagnetic force in nature, and the bonding electrons are also bound electrons. The mass of the bound valence electrons changes while the charge of the electrons and nuclei remains the same, and the distance between the molecules will be shortened.

2.5. Reduced Vibrational Frequency of Ions in Ionic Compounds

For ionic compounds, the mass of the ions at each lattice point within the crystal increases due to motion. In this way, the vibration frequency of the ion is reduced (the reason is that the vibration of the ion is a reciprocating motion, and the state of motion needs to be changed continuously, and the increase in mass makes it more difficult to change the state of motion), and the volume of the ion and the volume of the crystal will decrease accordingly. The volume of the crystal shrinks in all directions. Molecular thermal activity in liquid and gaseous substances also decreases as the molecular mass increases.

2.6. The Entropy of an Adiabatic System Is Reduced by Motion

For a closed system, if its volume decreases, its entropy will inevitably increase. On the contrary, its entropy decreases and its volume must decrease. For adiabatic non-solid matter, the mass of its components increases, the mass of particles increases, the thermal motion activity decreases, the degree of disorder of the system decreases, the entropy decreases, and the volume decreases. In short, when the mass of the molecules in the gas or liquid increases due to motion, the thermal motion of the molecules decreases, their entropy decreases, the distance between molecules decreases, and the volume decreases.

Sections 2.5 and 2.6 describe the thermodynamic mechanism of the contraction of matter due to motion. The shrinkage it causes is also three-dimensional volume shrinkage.

To sum up, for objects composed of a large number of molecules or ions to contract due to motion, even though quantitatively there is a difference from **Eq. (12)**, qualitatively they all contract in all directions due to motion. The thermodynamic mechanism in the above contraction mechanism is obviously also a physical mechanism for the lifespan extension of the moving organisms. That is, the physical mechanism by which a moving mechanical clock slows down. These factors (physical mechanisms) act simultaneously on a moving object. It's just that for objects of different natures, different factors play different roles.

3. Problems in the View Defaulted by Special Relativity

Questions about the tacit argument of special relativity are both hard to spot and hard to understand. Therefore, this paper discusses this aspect in a variety of ways. In the previous section, we have already started to discuss the default view problems of special relativity, and highlighted their connection with the quantitative analysis results of Section 3. In this section, we will analyze them one by one against the default views of special relativity introduced in the introduction. The multiple defaults of special relativity are closely related. In the next section we focus on the interconnectedness of these default issues.

Default view 1. The mathematical coordinates in the Lorentz transformation are the real space-time coordinates. Without this clause, special relativity cannot be applied in practice, and can only stay in a purely theoretical state. The

mathematical coordinates (x, y, z, t) in the Lorentz transformation the real space-time coordinates. If there is no evidence, we can only assume that the two are the same. This tacit opinion was certainly subjective when it was made. After the special theory of relativity was popularized, people looked for evidence in practice or with experimental methods. In the practice of electrodynamics, the default view is that it can indeed solve many practical problems. However, the application of a point of view to one discipline is not a substitute for application to all disciplines. There are local coincidences everywhere. It is possible that the reason for this is that electrodynamics effects happen to be related only to relative motion. The fact that the Lorentz transformation can be used in electrodynamics also does not rule out that "the coordinates in the Lorentz transformation are formal space or apparent (subjective) space ^[17]". Section 2.2 introduced that the moving object can shrink due to the mass of the internal particles changing due to the movement. This contraction is independent of the "contraction of space due to motion" caused by the Lorentz transformation. The theory of relativity also admits that "this mathematical contraction of space and time can cause objects embedded in space to be held hostage to shrink synchronously" is true (and has nothing to do with the internal composition and structure of moving objects, and is independent of the shrinkage of the internal composition and structure of objects. mechanism). In this way, a double contraction of the moving object occurs. Since the space coordinate axis in the Lorentz transformation can be extended infinitely, maintaining the default view 1 also needs to admit that "the space in the motion system is infinite, and the space of the system associated with the inertial motion is also infinite". There can be multiple inertial motion objects in the cosmic space (an observer can also observe multiple motion systems at the same time), so there are multiple infinite system spaces, and these infinite spaces are interspersed with each other (in this kind of space) premise). The space that can do interspersed movement without any interaction can only be a static and apparent (subjective) space (it is the space in the subjective consciousness of people, not the real space).

A space for movement can be created artificially (**Default View 2**). Without this, there would be no experimental method to verify the special theory of relativity. A typical example provided by relativity scholars for '**Default View 2**' is that the space inside the carriage of a train moving in a uniform straight line is an artificial motion space. However, this artificial space is more like an apparent (subjective) space. The reason is that one cannot accelerate a piece of vacuum anyway. A space with nothing cannot receive the action of any force, nor can it impart the action of force to any matter. Even a space full of virtual particle pairs or fields cannot be accelerated by the container walls (as long as the fields are not emitted by the container walls). Accelerating an object can only cause the object to move (traverse) in space, rather than creating a moving space by the way. In this way, the motion state of the empty space can only be determined by people in their consciousness. As long as there is no God's first push, the void cannot be accelerated by the force of nature, which determines that the void space can only be absolutely static. There is further evidence to support this argument.

Space shrinks due to motion, causing the length (or volume) of objects embedded in space to shrink due to motion, and the equivalent default is that the contraction of space due to motion is equal to the contraction of the length of the object due to motion (this is **Default view 3**). "The contraction of space due to motion determines that the length or volume of objects embedded in space is shortened due to motion", that is, it lack of evidence that space contraction can hold (entrain) objects in space to shrink synchronously (the **Default View 3** lacks evidence). However, without this one, there would be no inference that the length of the foot is shortened due to movement, and it can only stay on the "space shrinks due to movement". Space cannot be accelerated by force, and without the first push of God, there can be no movement in space. If there is no movement in space, it cannot be said that the space shrinks due to movement. When the vehicle accelerates, the passengers in the car do not accelerate synchronously with the car (If the passenger is in a frictionless wheelchair, the passenger cannot be accelerated by the accelerating carriage at all). This irrefutable fact shows that space cannot hold the objects in it to accelerate and move together. The mechanical performance of objects in the carriage that is always moving in a straight line at a uniform speed has covariance. The phenomenon can be explained by the principle of relativity or by the object conforming to the law of inertia. Choosing the latter interpretation allows the existence of an absolutely stationary system. What's more, Galileo's principle of relativity is approximately established in the low-speed motion system, and the existence of the absolute stationary system is not ruled out (*i.e.*, in the case of low velocity, the approximate covariance of the laws of mechanics cannot rule out the existence of an absolutely stationary system). It can be seen that the space in the car that can be accelerated together with the car and can move together with the car can only be the apparent (subjective) space at most.

The content of the **default view 4** is: the observer inside the motion system cannot feel any changes in the cause of motion of himself and the objects and space around him; when the relative velocity drops to zero, the phenomenon observed by the relatively static observer must be return to the state when the observed is relatively stationary (*i.e.*, the process of space-time change due to motion is reversible). Without it the principle of relativity does not hold. Any method that can prove that the special principle of relativity does not hold can prove that the default is not true. The conclusion obtained through quantitative analysis in **Section 2.3** is that a very small object can become a black hole as

long as its speed is very close to the speed of light. Once an ordinary object becomes a black hole, it will be shredded (especially a living thing, once it moves so fast that it tends to become a black hole, it will be shredded after death). Two observations, A and B, are moving at super high speed. After A observes that B becomes a black hole and is torn apart, "B still feels that he is still alive." It is difficult to understand and imagine. That is, once A observes that B has been torn apart and completely dead, it is impossible for B to return to a normal, alive state by slowing down greatly. Unless the relativistic mass-velocity relationship is apparent (subjective), otherwise, as long as the movement causes the mass of the object to increase and eventually the moving object becomes a black hole, the black hole is still a black hole after it is at rest, and it is impossible to restore its original non-black hole state only by changing the relative speed. Default view 4 has another contradiction. In the above example, after A observes that B becomes a black hole, B should become a small sphere (the reason is **Eq. (12)** and the mass-velocity relationship of relativistic theory).

Real objects have real internal composition and structure. If this is not required, the default view 1, default view 3 and default view 4 will not hold. Because, considering the composition and structure inside the object, the increase in the mass of the particles inside the moving object due to the motion will also cause the object to shrink (and even become a black hole, causing space distortion and breaking the special principle of relativity). In this way, the object should have a double contraction in the direction of motion. **Default view 5** denies the internal composition and structure of moving objects and treats moving objects as rigid bodies, and discuss the theory of relativity would be out of touch with reality. Since relativity is an exact description, it cannot be approximated. Within the framework of the theory of relativity, no matter how hard an object is, it cannot be approximated as a rigid body considering its internal composition and structure. Since it is not true, it is not a suitable occasion for approximation, or it is an incorrect view, theory and behavior.

The special theory of relativity does not talk about the physical mechanism of relativistic contraction, and regards the moving object as a rigid body, while the moving clock does not regard it as a rigid body. This is the default view of special relativity⁶ (and a theoretical act). Only the apparent (subjective) contraction of empty space-time due to system motion does not require a physical mechanism of contraction. However, the internal particles of real objects change due to motion. However, the internal particles of real objects will undergo real changes due to motion (especially changes determined by the relativistic mass-velocity relationship). This change has a real physical mechanism. Therefore, a theory that does not give a specific physical mechanism for the contraction of an object due to motion (or does not admit that the process has a real physical mechanism) is a theory out of reality. Special relativity ignores the internal composition and structure of an object when it discusses the contraction of an object due to motion. In this way, we cannot discuss and apply the relativistic effect of slowing down the clock of motion. Should a moving clock body be regarded as a quasi-rigid body or should it be regarded as a real object with internal composition and structure?

Default view 6: Special relativity doesn't talk about the physical mechanism of relativistic contraction (it's an action, not an opinion). In the framework of special relativity, space shrinks due to motion, and there is no complete physical mechanism for objects shrinking due to motion. "Space shrinkage causes objects embedded in space to shrink" is just a small fragment of the physical mechanism of the shrinkage of objects due to motion, not the complete physical mechanism of the shrinkage of objects due to motion, and it does not necessarily conform to the facts.

4. Representation of Space-time Shrinkage — Two-dimensional Lorentz Contraction and 4D Space-time Contraction

Whether the concept of space-time continuum is used or not, the contraction of space-time of the system under Lorentz transformation due to motion is a two-dimensional contraction (both a spatial coordinate and a temporal coordinate contract due to motion). Since the four coordinate axes in the kinematic system are all shortened due to motion, it is inappropriate to call the contraction of the space coordinate axis shrinkage, and the contraction of the time coordinate axis as time dilation.

If $x_1=x, x_2=y, x_3=z, x_4=\tau=ict$, **Equation (2)** the general Lorentz transformation can be written as

$$x_1 = \frac{x' - i\frac{v}{c}x'_4}{\sqrt{1 - (v/c)^2}}, x_2 = x'_2, x_3 = x'_3, x_4 = \frac{x'_4 + i\frac{v}{c}x'_1}{\sqrt{1 - (v/c)^2}}. \quad (17)$$

It can be seen from **Eqs (2)** and **(17)** that, measured in the stationary system, the length and time values in the moving system decrease simultaneously (*i.e.*, x_1 and x_4 change in exactly the same direction and way). This is the result obtained according to the Lorentz transformation. The above-mentioned "magnitude reduction" can be referred to as "shrinkage" or "shrinkage" by unifying the caliber. In this way, the Lorentz contraction is a linear contraction of two-dimensional space-time:

$$\left. \begin{aligned} x'_1 &= x_1 \sqrt{1 - (v/c)^2} \\ x'_2 &= x_2 \\ x'_3 &= x_3 \\ x'_4 &= x_4 \sqrt{1 - (v/c)^2} \end{aligned} \right\}. \quad (18)$$

It can be seen unambiguously from the Lorentz transformation that both time and space change due to motion with $\sqrt{1 - (v/c)^2}$ as the denominator. The expression "space shrinks due to movement, time expands due to movement" is easily misunderstood. Expressing the Lorentz contraction as a two-dimensional space-time contraction is somewhat more accurate (*i.e.*, more canonical), as long as the concept of space-time is used.

The main text has demonstrated that the reduction in volume of a moving object (*i.e.*, volume contraction) is a three-dimensional contraction. Also take into account that the time value becomes smaller due to movement (*i.e.*, contraction). That is, the space-time contraction of the moving material system is the four-dimensional relativistic contraction. The lateral Doppler shift formula that can describe the effect of time motion is $t = t_0 \sqrt{1 - (v/c)^2}$. In the same way [compared with the reason obtained from the **Eq. (18)**], in the case where the system speed is not very close to the speed of light, that is, when the gravitational effect of moving particles can be ignored, the volume contraction of atoms and molecules determined by quantum mechanical factors is as follows [Considering **Eq. (11)** in the text]:

$$\left. \begin{aligned} r_x &= (r_x)_0 \sqrt{1 - (v/c)^2} \\ r_y &= (r_y)_0 \sqrt{1 - (v/c)^2} \\ r_z &= (r_z)_0 \sqrt{1 - (v/c)^2} \\ t &= t_0 \sqrt{1 - (v/c)^2} \end{aligned} \right\}. \quad (19)$$

Borrowing the concept of space-time, the time value and the volume value of the object in the motion system decrease due to motion can be represented by **Eq. (19)**. In other words, if, like the special theory of relativity, we also regard the space full of objects as an apparent (subjective) four-dimensional space, **Equation (19)** is the expression of the motion effect of four-dimensional space-time.

5. Conclusion and Outlook

This paper adds a lot of new knowledge to the human knowledge base, which can change part of the human view of nature. First, the volume of real objects shrinks in all directions due to motion, with well-defined physical mechanisms. The relativistic effects of particles (especially molecules, atoms, and electrons) that make up objects should not be completely ignored (when discussing the spatiotemporal variation of the kinematic system). Different objects or the same object move at different speeds, and the laws of their volume shrinking due to movement are not completely consistent. The Lorentz contraction expression in the context of relativity cannot correctly describe the contraction of an object that does not ignore its internal composition and structure due to motion. Second, when a real object moves, the mass of its various parts increases according to the mass-velocity relationship, which will produce a general relativity effect that cannot be ignored — the space bending of the ultra-high-speed moving system (and even the collapse of the object). Third, there is only one real cosmic space, so the space that can move and can be accelerated associated with many moving objects (this is also the space in the Lorentz transformation chosen by the special theory of relativity) can only be a theoretical space or Mathematical space (also called virtual space). It is difficult to speed up infinite space. "In the only real cosmic space, there are manyinfinite spaces with multiple interlaced motions" has a logical problem. Fourth, the above conclusion that "there is only one real cosmic space" shows that the applicable scope of the principle of relativity is limited. The collapse of an object due to motion cannot be relative. The contraction of an object due to motion cannot be relative.

3D relativistic contraction, 2D Lorentz contraction and dynamic mass black hole are all new words obtained in this paper. The conclusion that "an object can become a black hole with a moving mass when it moves at a high speed with inertia" destroys the conclusion that "the internal structure of an inertial moving object remains unchanged" in the special theory of relativity. This limits the scope of application of special relativity and its principle of relativity. A moving mass black hole is equivalent to a moving black hole. According to Hubble's law, the retrograde speed of

celestial bodies far from the earth can approach or exceed the speed of light. Therefore, it is valuable to discuss the relativistic effect of ultra-high velocity motion.

Equation (11) is theoretical, and it is necessary to design appropriate experiments to verify "whether the moving object shrinks in all directions".

As long as the moving object is not regarded as a rigid body and the Lorentz contraction is considered, there are three kinds of contractions of space-time (or objects) in the moving system: the moving object shrinks in the direction of motion; Space-time in hyper-velocity systems bends and objects can collapse. We must choose between these three relativistic effects (and\ or discuss the conditions under which they arise).

The discussion of this paper is disadvantageous to the well-known "relativity of rod contraction due to motion". We need to search for more evidence in order to reach a final conclusion.

No matter what kind of theory, as long as there is a logical contradiction, it shows that it is imperfect. It's time for a change in treating relativity as the sacred bible, thereby not allowing the inadequacies of relativity to be talked about in influential places.

For the big PK mentioned in the title of this article, if everyone finally agrees that the three-dimensional shrinkage side wins, we have to consider abandoning the principle of relativity and reducing the scope of application of the space-time theory. So there is a lot of work waiting for us to do.

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Supplementary Material A: Cover Letter

Dear Editor:

Before this paper, many people have exposed the logical paradox of relativity. However, the author of this paper discusses what relativity does not discuss—**First**, the relativistic effect of the moving system is discussed without neglecting the internal composition and structure of the moving object; **Second**, in the first case, what happens to the system with mass when the object is very close to the speed of light. The conclusion of the discussion becomes the highlight of this paper.

This article has the following highlights. According to the mass-velocity relationship of the special relativity, the conclusion that the volume of a real object composed of particles in a moving object will shrink in all directions (contains a quantitative relationship between volume and velocity applicable within a certain range). This is to expand the relativistic effect of only shortening the length into the effect of reducing the volume in all directions (the 1D shrinkage effects is extended to the 3D shrinkage effect). This expansion process is also the process of revealing the physical mechanism by which objects contract due to motion. As long as the relativistic mass-velocity relationship is identified, even the inertial motion of an object will cause general relativity effects — the mass of objects and their internal particles in a motion system very close to the speed of light can become very large, and the space inside and outside of them can be distorted and even objects can collapse. This effect was ignored by special relativity in the past. Inertial motion can produce general relativity effects that everyone has never heard (now hearing such a sound is the progress of human beings). Don't doubt its authenticity. Because as long as there is mass in the system, it will have general relativity effects (increasing mass, warping space, and even producing neutron stars or black holes) due to its motion.

In conclusion, as long as the mass-velocity relationship is acknowledged, we can get the following conclusions:

- (1) The internal space of a mass motion system can be distorted by inertial motion (abbreviation: space is curved by motion);
- (2) Physical particles can become neutron stars or black holes due to ultra-high-speed inertial motion (abbreviation: motion can create black holes);
- (3) The mass of the particles inside the object increases due to movement, which can cause the volume of the moving object to shrink in all directions (Abbreviation: Volume shrinks due to movement. Previous knowledge is that only length shortens due to movement). This contraction is not the Lorentz contraction; the Lorentz contraction is out of touch with reality.

These conclusions obviously add new knowledge to the human knowledge treasure house (filling part of the cognitive gap), and can change the human view of nature and certain theories. Before this, people habitually ignored the internal composition and structure of moving objects and only believed in the mathematical conclusion of Lorentz transformation. When people suddenly see the highlights of this article, they will be very shocked. Certain preconceived ideas in people's minds will be impacted. Since the Lorentz contraction is out of reality, the status of the theoretical criterion "covariance under the Lorentz transformation" is seriously threatened.

The important conclusion of this paper is to challenge the old view. I hope that editors and reviewers will not take the old viewpoint as the standard and ask the viewpoint of this article to obey the old viewpoint, but judge who is more accurate, more reliable and more practical between the new viewpoint of this article and the previous old viewpoint. The three challenges of this paper are as follows:

- a. "The inner and outer space of real objects are distorted by ultra-high speed motion (4D change of pace-time)" challenges "Empty space can only shrink due to movement (1D shrinkage of space)";
- b. "The volume of an object shrinks in all directions due to motion (3D shrinkage of an object)" challenge "The length of an object shrinks only in the direction of motion due to motion (1D Lorentz shrinkage)";
- c. "The system with mass can collapse into neutron stars or even black holes due to ultra-high speed motion" challenges "the internal order of the object (including the interaction between particles, the sequence of events and biological activity, etc.) will not change due to inertial motion. Changes in space-time or objects due to motion are reversible - stopping motion can restore the state before motion, except for changes not caused by motion".

In essence, these three challenges are challenging the conclusion that "objects in inertial motion can only experience Lorentz contraction".

Relativity is one of the two pillars of physics. The theoretical criterion of "covariation under the Lorentz transformation" has a high utilization rate (even has been superstitious by the world). The crisis of special relativity is also the crisis of the scope of application of this theoretical criterion. The results that reveal the crisis of special relativity will surely attract the attention of the majority of scientists and even science enthusiasts.

This article has important observations (inertial motion can cause the effect of general relativity, etc.), which is in line with the purpose of your journal.

Title: Three-Dimensional Relativistic Shrinkage PK One-Dimensional Lorentz Shrinkage

