A New Interpretation of the Special Theory of Relativity

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Abstract: ***The quantum mechanics interpretation hasno general agreement in the scientific community, meanwhile, it seems that for The Special Theory of Relativity, the community is satisfied with it. The author'sopinion is that after Einstein's general theory of relativity, he, or the physics community, could return and clear up some issues in this core theory of modern physics. Especially about the zero - time interval and singularity zone, a reasonable space contraction and time dilation, twin and barn - pole paradoxes, relativistic simultaneity, 4th dimension Ct as wavelength, a better spacetime grid, etc. Some of this fresh interpretation has already been given in the author's previous paper, new ones are included for a complete and unified novel interpretation.***

Keywords: special relativity, 4th dimension, relativistic simultaneity, space contraction, time dilation, spacetime, twin paradox, ladder paradox, energy wavelength

1. Introduction

The author has given in 2021 - 2a new quantum mechanics interpretation [1] [2] [3] proposing a challenging oscillating space between our observable 3D and the 4th"Ct" dimension. During this effort, some issues in The Special Theory of Relativity (STR) were aboard with a unique interpretation. This paper completes STR's new interpretation embracing all the known and proven equations. The only great change is the understanding of them; as can be read below.

1.1 Lorentz's gamma factor, space contraction.

Lorentz's 1/gamma factor [5]{1 - (V/C) ^2} ^ 0.5 makes the correct relation between observers at different inertial moving frames. It shows how kinetic energy affects space, time and mass values. The issue is that the actual interpretation says that space shrinks, time stops in that amount and mass increments. The space shrinkage has the issue of what happens with the difference of space between an outside observer value and the proper value. The other issue is that all the moving dimension shrinkages and only the zone where the kinetic energy is involved. This general shrinkage of the dimension contradicts Einstein's General Theory of Relativity (GTR) [6] and its locality relativistic effect. Rindler's barn - pole paradox (also ladder paradox) [7] comes from this shrinkage interpretation. If the space occupancy is left the same for all the inertial frames of reference, then there is no paradox and GTR locality is preserved. From the barn's view, the pole will continue not fitting, even at relativistic speed. Idem for the poles view, the barn will unfit in the same way as at rest. GTR locality will conserve the rest of the dimension outside the barn; the whole universe in the moving direction doesn't shrink. So, the clue is in maintaining the space occupancy and Lorentz's contraction refers to a smaller value due to a scale change; voila! Same as the scale ruler of engineers and architects, they contain six different values depending on each scale BUT the ruler space occupancy is always the same. See Figure 1 with case A being at rest, case Bat 86.6 % of C, case C at 96.8% of the speed of light and case D at 100% of the speed C.

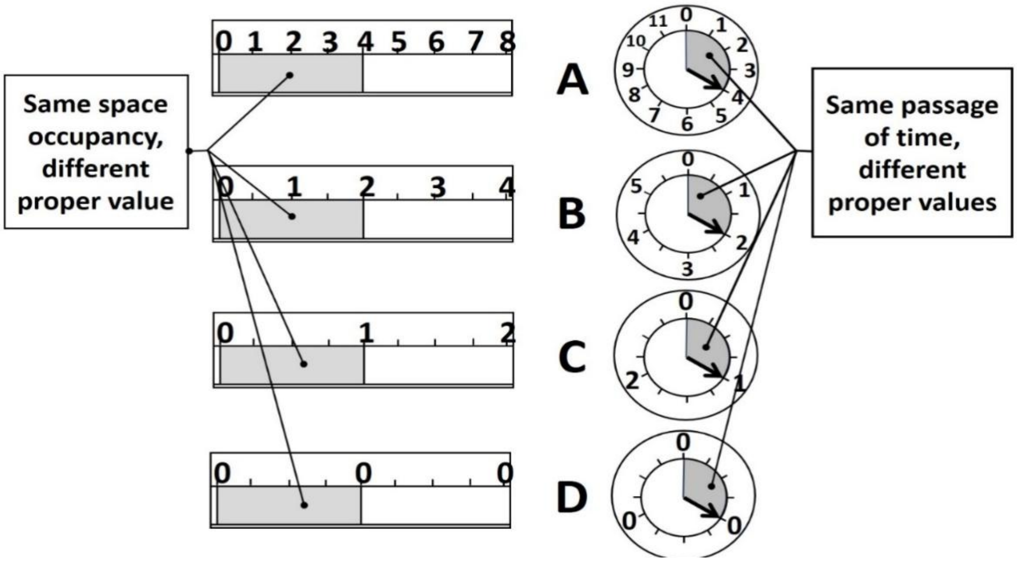

Figure 1 [4]

Now is easier to understand the Rossi - Hall experiment in 1940 and Frish - Smith, more precise experiment in 1962, over muons reaching the surface of the Earth (measured average relativistic factor of 8.4). They travel at 99% of C and their half - live decay from proper view is 2.2 μs and the proper distance traveled is 1.2 km, meanwhile, from an observer at the Earth's surface will decay in 18.5 μs and travel 10 km. Yes, 2.2 μs is equal to 18.5 μs (same passage of time) and 1.2 km is equal to 10 km (same space occupancy); the equality matches perfectly considering the scale change concept.

The same will happen with Ehren fest's disc spinning at a relativistic speed [8], its circumference won't break due to Lorentz's contraction. It's all a progressive scale change depending on its radius; no space contraction over the whole 2D involved in this relativistic movement.

1.2 Time dilation

The same interpretation as Lorentz - Fitzgerald space contraction, i. e., the space occupancy is maintained for all inertial frames of reference and only the space scale is changed by the observed total energy. For time is the same reasoning, the passage of time is maintained for all inertial frames of reference and only the clock scale dial is changed by the total energy. Understanding that the handle of all observer frame's clocks moves the same, the synchronization can be evident (see right side of Figure 1). Their value will depend on the total energy as expressed by the 1/gamma factor but all the observations can be related one to another even if their clocks have different values. Note that the physical behavior depends on each time value. In 1911, Einstein [9] cleared this up with traveling living organisms aging in accordance to its 1/gamma factor. So, in Langevin's paradox [10], the traveler twin is younger and can give a hug to his brother even if both have different time values (both at the same passage of time). In the muon experiment, Frish - Smith confirms that muons half live decay changed from 2.2 μs at rest, up to 18.5 μs due to this kinetic energy increment.

In October 1971, an experiment with three clocks was performed by Halafe - Keating [11]. They flew twice around the world, first eastward, then westward, and compared the cesium clocks against others that remained at the United States Naval Observatory. Each clock suffers the presence of its proper kinetic and potential energy but, meanwhile, they had different time values, the verification of those results was possible because they were at the same passage of time. Every day we experience this when we use the GPS system; the time value of the satellites is different from our time but we share the same passage of time. Note that the gravitational potential energy is opposed (negative) from kinetic energy, its effect over time is the same, both having Lorentz's time scale dilation instead of a faster time scale.

The goodness of this time dilation interpretation is shown when the observation is done at the speed of electromagnetic waves (light). The proper time of photons is zero (1/gamma = 0 when V = C), and this zero doesn't mean that they are at all times. They will follow the passage of time with the rest of the universe as drawn in case D, right side of Figure 1. Their proper space being also zero (space contraction when V = C) doesn't mean they are at all places in the moving coordinate, they will contain the space occupancy as drawn in case D, left side of Figure 1. With this new interpretation, the singularity and infinity values will be less confusing.

This case of space occupancy and time interval being zero is quite peculiar and sometimes misunderstood. The author reinforces it with the beginning of the universe. Our best understanding of it is the big bang hypothesis, where its proper zero - time interval doesn't mean the creation of time; the passage of time is present even when the time interval shows a zero value. With the same reasoning, at the beginning, the universe having a size of zero value doesn't mean just a point in space occupancy; a zero value can be the measurement - observation of a huge space and not space being created from a point. So, the big bang can be named the big black hole or the creation of space without containing energy (In the order of magnitude of our solar system; considering the mass of our observable universe as 1.5 10^53 kg plus 95.1% increment due to the dark matter and energy {unproven up to today}).

1.3 Simultaneity

As seen previously, the value of each local time depends on the previous presence of energy; so, events that are simultaneously at the same passage of time don't imply the same value of time unless the event is in the same place. For example, in the twin paradox, when they meet again, the traveler twin will be younger and their clocks will have different values. But from then on, both twins will have a similar time value variation.

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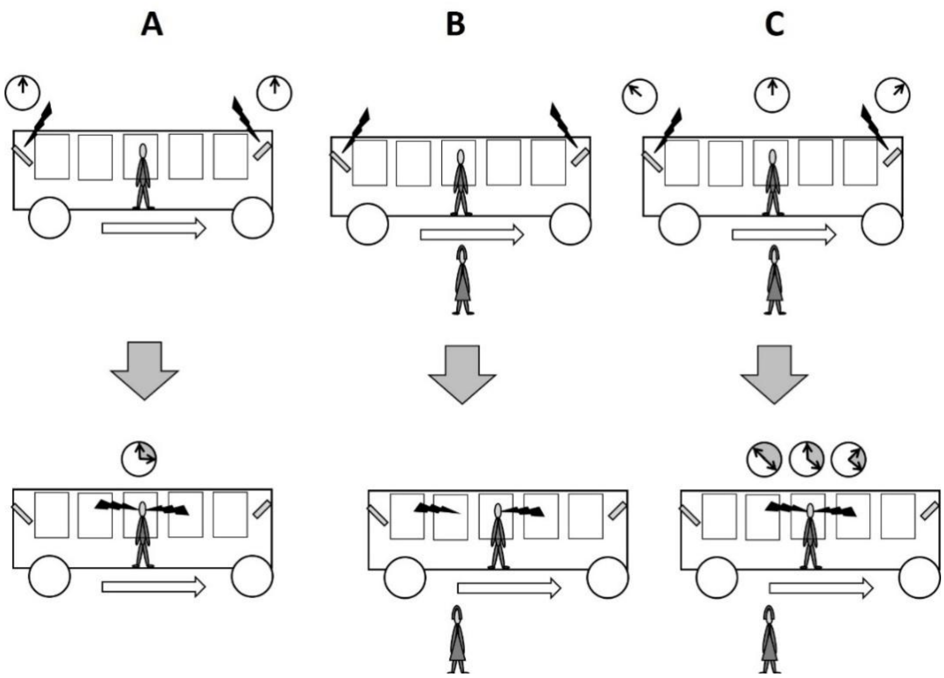

Figure 2 [4]

For example, let Bob include a mechanism that activates only when the two rays reach together from the left and right sides. In the previous case, if the mechanism activates from Bob's view, it must also be activated from Alice's point of view.

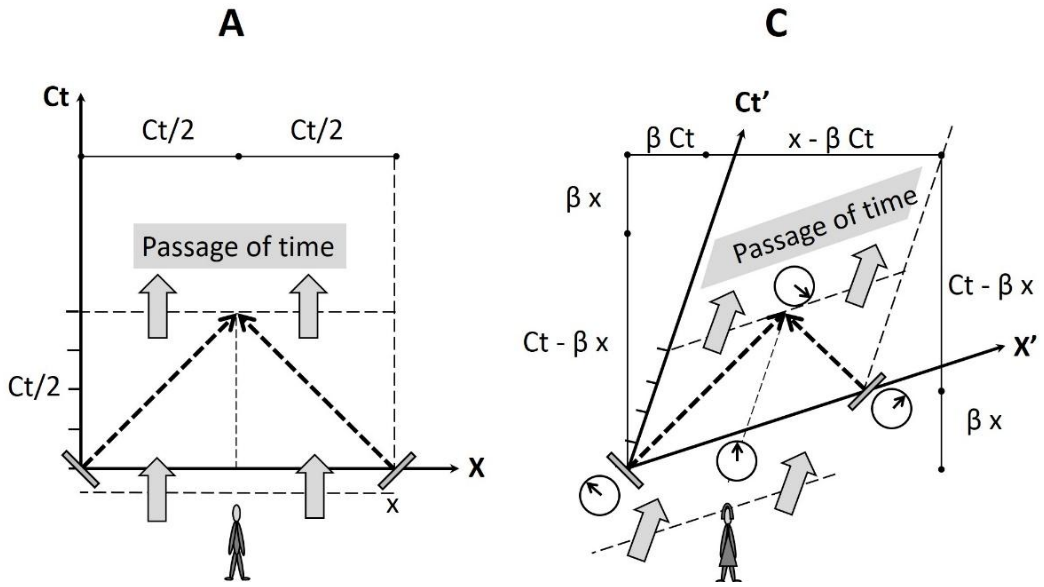

Figure 3 [4]

1.4 The Ct 4th dimension

On one hand, Einstein point out in his GTR, local and surrounding energy is the one that creates space contraction, as well, time dilation. On the other hand, Planck [13] proposed in 1900 that energy is discrete and proportional to the inverse of time (specifically a period) E = h*C / Ct. And in 1923, De Broglie [14] reinforce that characteristic of nature with his equation p = h / Ct. So, this "t" that is involved in the quantum scenario is not the Minkowski "t" of the evolution of events [15]. This quantum "t" is tiny as an "relativistic interval", not a macro value of hours, days, years etc. that is managed in events. This "Ct" is the 4th longitudinal dimension and it's intrinsically related to energy and to GTR. In other words, Ct will be lambda λthe wavelength of energy and this is the way to understand STR quaternions.

In 1905–06, HenriPoincaré [16] include the imaginary fourth spacetime coordinate i Ct as the four - dimensional. This four vector $(i\ C\ \Delta t)^2 + (\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2$is invariant and is interpreted as any decrement in Ct (smaller Lamba or higher energy) is related to a decrement of space or space contraction; i. e., energy affecting space and vice versa. This is what the Lorentz's factor gives and what is intrinsic in Einstein's STR.

For this reason, any description in nature, their classical longitudinal X, Y and Z values must contain the Ct information; i. e., 3D space values must contain their energy to achieve the correct space occupation as described in GTR. Another way to understand it is realizing that values without their scale is un incomplete description of nature. So, relativistic equation must be managed with a four vector!

Since energy has many manifestations in our 3D, this total energetic 4th dimension can be subdivided in its individual forms, i. e., mass energy, kinetic energy, electromagnetic energy, weak and strong forces, etc.

1.5 Modified spacetime grid.

The simplest spacetime grid is two - dimensional, one for space (just X) and the other for Ct. This second coordinate is commonly named time, but remember it is Ct. When two massive objects are near, the Ct axis doesn't make much sense. The distance Ct won't mean an event time multiplied by C; the masses are not time separated! A better way is to draw a "space - energy grid" where the coordinates are only space dimensions and the Lorentz's 1/gamma factor is registered inside each box.

1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.95	0.90	0.80	0.80	0.85	0.80	0.80	0.90	0.95	1.00	1.00
1.00	0.95	0.50	0.45	0.40	0.40	0.45	0.40	0.40	0.45	0.50	0.95	1.00
1.00	0.90	0.45	0.22	0.20	0.19	0.21	0.20	0.19	0.22	0.45	0.90	1.00
1.00	0.80	0.40	0.20	0.10	0.10	0.15	0.10	0.10	0.20	0.40	0.80	1.00
1.00	0.80	0.40	0.20	0.10	0.10	0.15	0.10	0.10	0.20	0.40	0.80	1.00
1.00	0.90	0.45	0.22	0.20	0.19	0.21	0.20	0.19	0.22	0.45	0.90	1.00
1.00	0.95	0.50	0.45	0.40	0.40	0.45	0.40	0.40	0.45	0.50	0.95	1.00
1.00	1.00	0.95	0.90	0.80	0.80	0.85	0.80	0.80	0.90	0.95	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Figure 4: Values in each box are not exact, only for understanding purposes

Figure 4 is an example of this two - dimensional space - energy grid including two massive objects; note that the values 1/gamma are just for demonstration purposes. The two coordinates can be space (X, Y) andenergy's wavelength Ct (Lambda) is implicitly represented by 1/gamma. Why not Ct with its own axis? Because the addition of each individual Ct (or 1/gamma) doesn't have a physical meaning. The addition of each individual X or Y gives a spatial distance and that is appropriate. Meanwhile, all boxes have the same drawing length, and each individual space value is affected by its own 1/gamma; note that longitudinal physical value will be smaller near the massive objects. In this way, Einstein's GTR can be understood, as energy contracting space; i. e., a scale dependence on energy. As a mental exercise, the reader can make their own 3 - dimensional grid having the union of cubes with sides being the X, Y and Z values and in the center the 1/gamma value; a cube with 4D information.

The common bent sheet can't be applied to a 4D, aside from the argument that it uses gravity to explain gravity. This is evident if thisis done at the international space station, even with a pre - deform sheet, the masses won't go to the lower level because they live the experience of zero gravity. Be aware that the gravity there is like 90% of the Earth's surface but they experience Einstein's equivalent principle [17]; space station falling to Earth together with the objects, astronauts, inside air and its space.

1.6 Block universe

In Figure 5A, the drawing represents the classical evolution of space through time, commonly known as the "block universe. " The reader can see space at a given time, i. e., the same value of time is all over a "flat" 3D space (drawn as 2D). Space evolves from smaller values of time (past) up to bigger values (future). So, the overlaid of space evolution forms a pile of space versus time or the block universe. Since the classic view of the universe is determinant, knowing all the physical parameters in a given moment (now), all the past and future events can be deduced and be known; classically, space evolution is an established - blocked space through time.

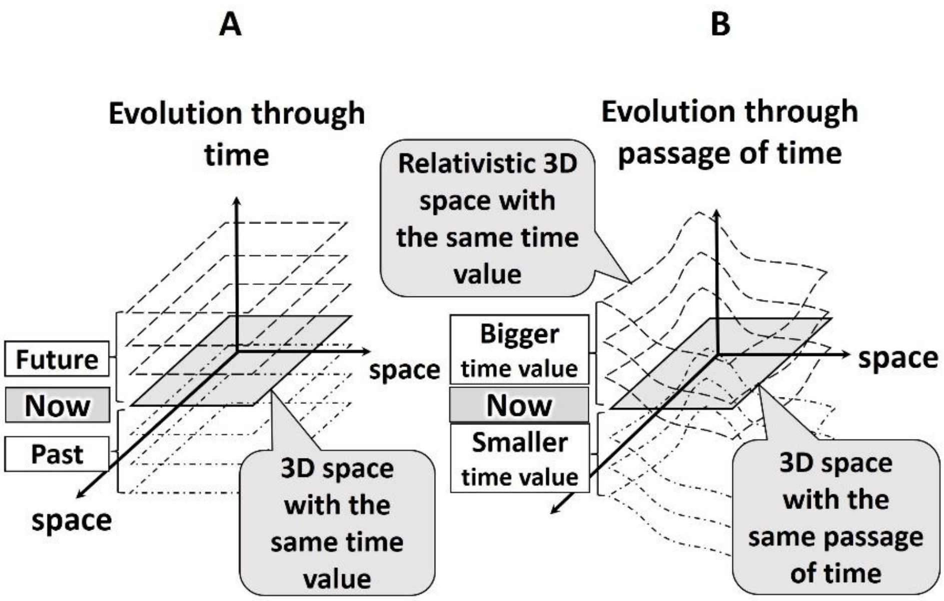

Figure 5 [4]

Figure 5B represents the real space through time. At a given instance, the time value will depend on the distance from the observation point and on the amount of energy that develops a local time dilation. The moment "Now" will be flat and will involve different values of time meanwhile the same value in time is drawn as a tilted and bent sheet (all as 2D for simplicity purposes). The simultaneity of physical events will involve many different time values but it happens in the same passage of time, i. e., simultaneously.

1.7 Kinetic and mass electric; electric and magnetic energy.

The Theory of special relativity joins kinetic with mass - energy; the total energy is expressed as $E^2 = (p\ C)^2 + (mC^2)^2$. Lorentz's gamma factor also reveals that the physical magnitudes of space, time and mass are affected by the presence of energy. Keeping this in mind, the twin paradox can be understood under these considerations. See Figure 6 where side A represents twin 2 view of his brother's twin1mass - energy variation staying at Earth, on the other hand, side B shows the twin 1 view of his traveler twin 2 energy increment due to its acceleration (energy from the rocket engine transferred from chemical energy to kinetic energy). Initially, both twins had the same $E_0= m_0C^2$ (below arrows). The traveler twin2 suffers a kinetic increment $p_2\ C$ so its total energy $E_2> E_0$. Meanwhile, from twin 2 view, his brother also has a kinetic energy $p_1\ C$ identical to what twin 1 sees of his brother $p_2\ C$; both kinetic energies are the same ($p_1\ C = p_2\ C$). The major difference comes from energy conservation, twin 1 doesn't have an energy increment, its $E_1 = E_0$; so, its mass - energy m_1C^2 is reduced to accomplish this conservation ($m_1C^2 < m_0C^2$). The only one that gets a time dilation it the traveler twin 2 and there is no paradox. Remember that the speed depends on the frame of reference but the energy doesn't; any observation from its own view (proper view) doesn't carry kinetic energy and its relativistic mass energy will include any kinetic energy view from an outside inertial frame of reference, i. e., Lorentz's mass increment.

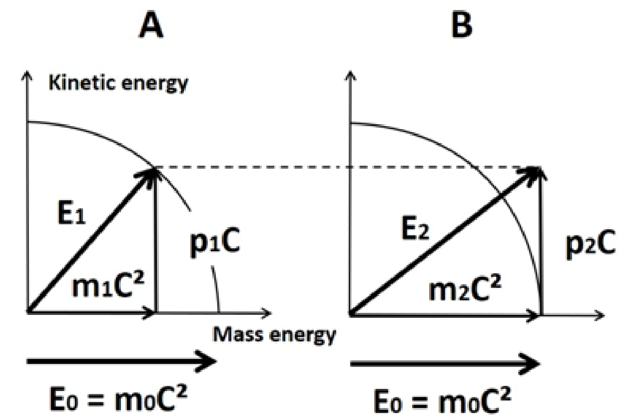

Figure 6

When an electric charge is moving o an inertial frame of reference see it moving, an electric current is included and so an energy increment; this apparent increment is compensated with the magnetic energy. Yes, a magnetic energy product of relativistic charge's space contraction must be contrary to the electric energy. This is appreciated in Maxwell's electromagnetic wave equations [18] where both fields get increments and decrements; and both values oscillate together and do not alternating (one increase and the other decreasing). Like in a pendulum, kinetic energy increments when the potential energy also increments in value but with a different sign, i. e., gets more negative (potential energy being contrary to kinetic energy). Electricity and magnetism go hand in hand as relativistic mass goes with kinetic energy.

2. Conclusions

After more than a century, the Theory of Special Relativity still needs an intuitive interpretation, time dilation, space contraction and mass increment as a scale change. The known spacetime relation must be replaced with the space - energy relation, as well as the time - energy and mass - energy relations; energy is the actor of Lorentz's gamma over the three physical parameters and not space over time or vice versa. This energetic intervention is a must for a 4 - dimensional treatment in physical equations. This4th dimension as iCt or its i/gamma value must be included when X, Y and Z values are taken; the value must include their scale. Another immediate conclusion is the subdimension of energy, each one will manage its proper partial Lambda.

Declarations

The author declares no conflicts of interest regarding the publication of this paper.

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