The Nineteen Postulates of Einstein's Special Relativity Theory

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Abstract

Since 1905, when Einstein introduced the Special Relativity Theory, various researchers independently observed that his theory contains at least one more postulate besides the **two postulates** stated by him explicitly [1]. Putting together all those observations about the *different* additional postulates, we will describe here how the Special Relativity Theory was unfortunately based on **nineteen postulates**, and how most of them were implied and used in Einstein's 1905 article, later in his article [2] of 1910, and also further in his manuscript [3] written between 1912 and 1914.

Method of presentation

First, the 19 postulates of Einstein's Special Relativity Theory (SRT) will be simply listed, most of them considered in the order in which he wrote them in 1905. For each postulate of that list, certain researchers who observed it and their texts will be mentioned accordingly. Then, following the list, we will discuss critically each postulate.

1. A list of the 19 postulates of Einstein's Special Relativity Theory

1.1. The first postulate of SRT

Title: the principle of relativity.

1.2. The second postulate of SRT

Title: the postulate of constancy of speed of light.

1.3. The third postulate of SRT

Title: the 1st postulate of rigidity: the **invariance of length in time**, for the bodies at rest.

- Observed by: Max Born [4] ; Harvey R. Brown [6].

1.4. The fourth postulate of SRT

Title: the 2nd postulate of rigidity: the **identity of length units** across systems.

- Observed by: **Albert Einstein** (!) [2] ; Max Born [5] ; Harvey R. Brown [6].

1.5. The fifth postulate of SRT

Title: the 1st postulate of synchronicity: the **identity of time units** used throughout all space.

- Observed by: **Albert Einstein** (!) [2] ; Max Born [5] ; Antony Valentini [7].

1.6. The sixth postulate of SRT

Title: the 2nd postulate of synchronicity: the existence of a **common time** of different points in space.

- Observed by: Y. B. Karasik [8] ; Valentin Danci [9].

1.7. The seventh postulate of SRT

Title: the 3rd postulate of synchronicity: the **unicity** of the method of synchronizing two clocks.

- Observed by: Valentin Danci [9].

1.8. The eight postulate of SRT

Title: the 4th postulate of synchronicity: the **definition** of the method of synchronizing two clocks.

- Observed by: Valentin Danci [9].

1.9. The ninth postulate of SRT

Title: the 5th postulate of synchronicity: the **universal validity** of Einstein's definitions of synchronism.

- Observed by: Wolfgang Engelhardt [10].

1.10. The tenth postulate of SRT

Title: the 6th postulate of synchronicity: the **transitivity** of the method of synchronizing two clocks.

- Observed by: N. David Mermin [11].

1.11. The eleventh postulate of SRT

Title: the postulate of **multiple measurements** of the unique physical space.

- Observed by: Valentin Danci, hereby.

1.12. The twelfth postulate of SRT

Title: the postulate of the **chosen sign** attributed identically to the X axes of two systems.

- Observed by: P.S.C. Bruskiewich [12].

1.13. The thirteenth postulate of SRT

Title: the postulate of **original coincidence** of two systems.

- Observed by: Valentin Danci [13], however not mentioned as a postulate.

1.14. The fourteen postulate of SRT

Title: the postulate of **simultaneous validity** of Galilean transformation and Lorentz transformation.

- Observed by: Valentin Danci, hereby.

1.15. The fifteenth postulate of SRT

Title: the postulate of **homogeneity** of space and time.

- Observed by: Wolfgang Pauli [14] ; Per-Olov Löwdin [15].

1.16. The sixteenth postulate of SRT

Title: the postulate of a system's time depending on the other system's time and space.

- Observed by: Valentin Danci, hereby.

1.17. The seventeenth postulate of SRT

Title: the postulate of **identical inertial speed** measured between inertial systems.

- Observed by: Per-Olov Löwdin [15] ; P.S.C. Bruskiewich [12].

1.18. The eighteenth postulate of SRT

Title: the postulate of **transformation's unknown constant** as function of inertial velocity.

- Observed by: Robert J. Buenker [16].

1.19. The nineteenth postulate of SRT

Title: the postulate of **post-acceleration mechanical equivalence** of any two arbitrary systems.

- Observed by: Valentin Danci, hereby.

2. Critical notes on each and all the 19 postulates of Einstein's Special Relativity

Let us see first some current dictionary definitions of the word "postulate", as for example, the ones given by the Merriam-Webster online dictionary [17]:

D1.) *A hypothesis advanced as an essential presupposition, condition, or premise of a train of reasoning.*
D2.) *Axiom.*
D3.) *A statement that is accepted as being true and that is used as the basis of a theory, argument, etc.*

From the perspective of the science of Physics, we need to distinguish between:

A.) a *hypothesis* - which implies the absence of experimental confirmation,
B.) a *statement of general acceptance* for a fact verified by experiments.

While A.) matches the meaning of the word "postulate", B.) matches the meaning of the word "principle". Clearly, Einstein mistook the word "postulate" for the word "principle" and used them interchangeably. As we will see, all 19 postulates used by Einstein in SRT are **hypotheses**, never verified by experiments.

Unfortunately, the Modern Physics followed him blindly, and it multiplied the linguistic and conceptual blunders of relativity for more than a century. However, at some point, Einstein realized partially this issue and tried to address it in his article of 1910, and in his manuscript of 1912-1914.

2.1. Critical issues of the first postulate of SRT

- the principle of relativity

• Einstein's words: "*[...] the same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good.*" (1905) [1]

The first postulate of SRT was meant by Einstein to encompass the laws of mechanics and the laws of "*electrodynamics and optics*". His opening argument from the 1905 article is very weak from a theoretical perspective, as his example of a magnet interacting with a conductor is poorly stated, and it proves nothing more than his wishful thinking about eliminating "*asymmetries which do not appear to be inherent in the phenomena*".

Further in 1910, there was no improvement of the postulate, as Einstein proclaimed without any experimental proof that: "*The laws governing natural phenomena are independent of the state of motion of the coordinate system with respect to which the phenomena are observed, provided that this system is not in accelerated motion*" [2].

It is important to reveal **two very different** versions of this postulate, as written by Einstein:

I.) In 1905 and 1910, he proclaimed such a principle for all physical laws of nature.

II.) In his 1912-1914 manuscript, Einstein stepped back from his extravagant claim of 1905, and he quoted Laue and defined the relativity principle as applied only to the laws of mechanics (i.e. equations of motion, by his details):

"*«Every coordinate system that is in uniform translational motion relative to a justified system is again a justified system. The equations of motion of any (**mechanical**) system are the same with respect to all such justified systems». We will call this proposition the relativity principle.*" [3]

Further in the manuscript, Einstein tried to articulate the "*apparent incompatibility of the Principle of Constancy of the Speed of Light with the Relativity Principle*", as in his reasoning he found the incompatibility of these three things:

" *(a) the relativity principle*
(b) the principle of the constancy of the velocity of light (Lorentz' theory)
(c) the transformation equations (II), or the law of the parallelogram velocities. "

A most bizarre aspect of his reasoning is the fact that he explained the relativity principle *(a)*, as we quoted it above, by deriving *(c)* - the Galilean transformation, noted in Einstein's text as "*transformation equations (II)*". We say that this is very bizarre, because further in his reasoning he decides that the culprit in this entire story is *(c)* - which, in his opinion, must be eliminated in order to solve the incompatibility.

In other words, Einstein finds that: *(c)* implies *(a)*; then *(a),(b),(c)* are all incompatible together; finally, he illogically concludes that *(c)* must be eliminated, in order to solve the standoff.

From a historical point of view, it was very unfortunate and incorrect how Modern Physics followed Einstein just after 1905, by adopting uncritically the first postulate of SRT in its version I.) - as we can see nowadays in any textbook about relativity - e.g. [18].

It is also regrettable that Modern Physics did not follow Einstein's attempt to find a reasonable way to extend the relativity principle (of version II), from Mechanics to Electrodynamics. An incorrect extension

still prevails nowadays in Physics, as a consequence of his many hypotheses (of Special Relativity) and not as a consequence of any physical experiments. It is therefore important to conclude that:

A principle of relativity addressing all laws of nature cannot be a pre-requisite of the Special Relativity Theory, because such a generalization is in fact clearly a result of SRT.

2.2. Critical issues of the second postulate of SRT

- the postulate of **constancy of speed of light**:

• Einstein's words: "*[...] another postulate, [...] namely, that light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body*" [1]

As in the case of the first postulate, during the XXth century, the second postulate of SRT was blindly and uncritically accepted by the Modern Physics, despite a certain evolution in Einstein's efforts to explain it better in the years between 1905 and 1914.

The second postulate is nowadays incorrectly stated as: the constancy of velocity of light in any inertial reference frame (IRF). However, that is not what Einstein wrote in 1905. As we can see from the quote above, the constancy of speed of light is specified "*in empty space*", which means that the empty space was vaguely implied by Einstein as container for the propagation of light.

However, in the 1905 text, it is not clear which reference would be used to measure the velocity of light. Later, in the 1912-1914 manuscript, Einstein refined his reasoning: he started from the existence of one system in which the speed of light is isotropic:

> " *Hence, in accordance with Lorentz's theory we can **proclaim** the following principle, which we call the «principle of the constancy of the velocity of light»: «There exists a coordinate system with respect to which every light ray propagates in vacuum with the velocity c.»* " [3]

Hence, we notice the evolution of the argumentation for this postulate: in 1905, the second postulate was a mere proclamation of the constancy of the speed of light, without having any concrete experimental proof. Later, in 1910, and then in 1912-1914, Einstein started the reasoning from the existence of only one system in which the postulate is valid, and then he brought up one experiment - the Fizeau experiment [19] - as he thought it would help him **extend** this postulate to other inertial systems.

Thus, he tried to show that Fizeau's experiment proves that the anisotropy of light cannot be observed from a non-privileged inertial reference frame (IRF) such as Earth (during a brief experiment).
It is puzzling to notice how Modern Physics did not catch this blunder of Einstein in more than a century: Now it is very clear for us that Fizeau's experiment can measure **only** the anisotropy of light in a medium (such as water) which moves relative to an observer at rest in an IRF, not relative to ether.

And so, the velocity of light V in the moving water is (in Einstein's notations of 1912-1914):

$$V = V_0 + \mathbf{q_l}\,(1 + 1/n^2) \quad \text{where:}$$

- V_0 is the average velocity of light in water at rest with the observer/laboratory - not at rest in ether!
- $\mathbf{q_l}$ is the velocity of water relative to the observer/laboratory - not relative to ether!

Obviously, the variation of the experimental results is dependent only on the relative velocity $\mathbf{q_l}$ between the medium (having the optical constant: n) and the IRF. That provides no indication of the motion of that

IRF relative to anything else, i.e. no indication of the motion of water's comoving IRF relative to ether. Hence, the motion of the IRF relative to the hypothetic ether, or equivalently - the anisotropy of light in the IRF itself - **cannot be determined by Fizeau's experiment**.

Therefore, we now commend Einstein's eventual attempt to justify his second postulate by an experiment of Optics, in his 1912-1914 manuscript, but we also remark that he failed in that attempt, and that afterwards, Modern Physics just kept using that second postulate as it was initially written in 1905 and unproven experimentally.

Corollary of 1st and 2nd postulates of SRT:

With the first postulate extended from Classical Mechanics to Electrodynamics incorrectly (i.e. illogically, and in the absence of any experimental proof), and with the second postulate proclaimed valid for any inertial reference frame (again in the absence of any experimental proof), the modern science of Physics made generations of physicists believe in SRT as a first theory of Physics based on nothing else than pure imagination.

2.3. Critical issues of the third postulate of SRT

- the 1st postulate of rigidity: the **invariance of length in time**, for the bodies at rest.

  • Einstein's words: "*The theory to be developed is based—like all electrodynamics—on the kinematics of the rigid body, since the assertions of any such theory have to do with the relationships between rigid bodies (systems of co-ordinates), clocks, and electromagnetic processes.*" [1]

The great importance of the concept of a rigid body was stated by Max Born in his 1909 article, in which he conceived a new definition of rigidity for the Einstein's newly introduced theory of Special Relativity:

> "*the requirement that lengths shall be mutually comparable at different times, directly leads to the formation of the concept of measuring rods whose length is independent of time and motion, i.e., which are rigid.*" [4]

Starting from a definition of "the rigid body of old mechanics", Max Born developed further his new definition of the rigid body described in the Minkowski 4-dimensional space (a.k.a. space-time), as such definition was - according to his intention - suitable for Einstein's relativity theory.

Ignoring for the moment such an abstract definition made in an abstract 4-dimensional space, we should agree that although many experiments of Physics show that the lengths of all objects vary in time, it is possible to approximate to zero very small variations of certain objects - which objects can be used further in practice as standard units of measurement.

In conclusion, the 3rd postulate of SRT was:
- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- necessary to the conceptual structure of SRT.
- proven experimentally only in an approximative sense.
- unproven experimentally in the exact sense.

2.4. Critical issues of the fourth postulate of SRT

- the 2nd postulate of rigidity: the **identity of length units** across systems.

• Einstein's words: "*In accordance with the principle of relativity the length to be discovered by the operation (a)—we will call it "the length of the rod in the moving system"—must be equal to the length L of the stationary rod.*" (1905) [1]
" **«**footnote**»**: *It should be noted that we will always* ***implicitly assume*** *that the fact of a measuring rod or clock being set in motion or brought back to rest does not change the length of the rod or the rate of the clock.*" (1910) [2]

To clarify the difference between the previous postulate and the one discussed in this section, we will define them briefly next to each other:

- 1st postulate of rigidity: is about rigidity considered only in a coordinate system.
- 2nd postulate of rigidity: is about rigidity considered in any two different coordinate systems.

The postulate discussed in this section can also be fairly named the anti-FitzGerald-Lorentz hypothesis, because while the older hypothesis of FitzGerald [20] and Lorentz [21] implied that the lengths of similarly standardized bodies are different (in a function of their motion relative to the presumed ether), this second postulate of rigidity (in SRT) claims on the contrary: the lengths of measuring rods are physically identical in any different inertial systems.

The issue with the second postulate of rigidity is: in order to define a rigid body **across** different coordinate systems there is a need of a universal standard to which the dimensions of the body can be compared. Moreover, such a standard needs to be immutable in time and unaffected by any mechanical or electromagnetic phenomena. Therefore, the physical entity which would enable such a standard to manifest in reality should be an absolute reference for comparisons performed on spatial dimensions.

It is obvious how the need of defining a rigid body implies to the need of having an absolute reference in the physical space. Further, as Max Born's new relativistic definition of rigidity was developed for the 4-dimensional Minkowski space, we find that the second postulate of rigidity here implies also that the Minkowski space must be unique and used as an absolute reference.

Knowing that the Minkowski space is an abstract construction which has never been connected in any way experimentally with the reality of the physical 3-dimensional Space, such a demand of its unicity and its absoluteness can only be met by SRT by proclaiming just another postulate - which will be discussed in a different article in the future.

The equality between the length of a *measuring rod* set in motion and the length of a *measuring rod* at rest, as proclaimed by Einstein, cannot be physically proven without employing a method of comparison of those lengths. As Einstein did not indicate any such method, the well-known natural method of comparison is to be employed: the lengths of two objects are compared by placing them next to each other and marking **transversally** the ends of one object against the other object (see [22], p.48).

The result of such comparison, in the context of this postulate, applied to any rigid objects placed at any locations on the X, Y, Z axes of two different systems will result in **complete identity of any distances** marked on the two different coordinate systems. It follows immediately that the transformation of coordinates between the two systems is the **Galilean transformation**. Such conclusion makes any further attempts of deriving a different transformation (e.g. Lorentz transformation) evidently futile.

We can conclude that this 4th postulate is contradictory to the entire Special Theory of Relativity, besides from being experimentally unproven.

Nevertheless, we need to address the question of whether this is a distinct postulate or a consequence of the Principle of Relativity. Max Born considered it as another postulate of SRT (besides the first two):

> "*We may call this tacit assumption of Einstein's theory the «principle of the physical identity of the units of measure»*." [5]

Other researchers have disagreed with Born. For example, Yves Pierseaux wrote:

> "*This is not a third hypothesis because Einstein's deduces the identity of his rods from his relativity principle. The rigidity is not important. The important thing in the spirit of the young Einstein's text, is to postulate the existence in Nature of processes giving units of length and time.*" [23]

While we see Einstein's words ("*In accordance with the principle of relativity...*"), we will show that Pierseaux' statements are wrong. First, he unfortunately confused the notion of a measuring rod with the notion of a process. Einstein referred only to measuring rods, not to "*processes giving units of length*".

Then, even if a hypothetical fundamental law of Nature is to provide an immutable length to a rigid object in inertial motion, such hypothesis cannot hold true while the object is set into a new state of motion. As being set in motion involves the existence of forces and non-inertial systems, such a phase in the existence of the object is out of the reach of the relativity principle.

In other words, the Principle of Relativity, as stated by Einstein between 1905 and 1914, does not cover the non-inertial transition between states of motion, nor the rigidity of the objects before and after the transition. It only guarantees that the equations of motions are valid in either state of the inertial motion.

In conclusion, the 4th postulate of SRT was:
- stated in Einstein's introductory text of SRT, however not as a postulate.
- necessary to the conceptual structure of SRT, but not fitting, i.e. contradicting SRT's demonstrations.
- invalid logically, in the absence of comparison methods for lengths, as in such case it annuls the need of deriving a new transformation of coordinates (such as the Lorentz transformation).
- unproven experimentally (as again, there are no relativistic methods of comparison specified).
- the antithesis of the FitzGerald-Lorentz hypothesis.

2.5. Critical issues of the fifth postulate of SRT

- the 1st postulate of synchronicity: the **identity of time units** used throughout all space.

> • Einstein's words: "«footnote»: *Thus, we **postulate** that two identical phenomena are of the same duration. The perfect clock thus defined plays a role in the measurement of time that is analogous to the role played by the perfect solid body in the measurement of lengths*[...]«text»: *To determine the time at each point in space, we can imagine it populated with a very great number of clocks of identical construction.*" (1910) [2]

Although this postulate is neither mentioned nor implied in Einstein's 1905 text, the quote from his 1910 text shows that he eventually considered the identity of the time units provided by different clocks of

identical construction. The definition of a clock and the definition of the time unit provided by a clock came later, in his 1912-1914 manuscript:

> "*We imagine a completely isolated physical system that repeatedly assumes a specific state Z. Then the state Z is always followed by the states Z', Z", etc., until the state Z is reached again. The system is changing its state* ***periodically****. We can then count how often the system, which we shall call "****clock****", assumes the state Z; we will call this number the "temporal determination" of the clock.* " (1912-1914) [3]

It is obvious at this point that the periodical change of the state Z must be assumed as identical to the previous changes and identical to the next changes of that state Z of the same clock. That means the time unit of a clock between any two consequent changes of the state Z of a clock must be the same.

Further, two different clocks of "*identical construction*" are assumed to provide identical time units.

When it comes to the postulate of identity of the time units across different IRFs, as Max Born remarked it (although together with the identity of length units across IRFs), we have to say again that such a postulate is not determined by the first postulate of SRT (the Principle of Relativity).

As we remarked before, the transition from one state of inertial motion to another state of inertial motion cannot be obtained without the use of accelerations and forces. The material structure of the clocks and its rigidity, and their underlying functioning principles, are questioned in the presence of applied forces. Therefore, the identity of time and space units cannot be guaranteed after a transfer of a clock between IRFs, unless it is postulated.

Antony Valentini wrote a similar remark in that regard:

"*It might be thought that the third postulate could be dispensed with, by using the relativity principle to deduce that any specific process for constructing rods and clocks must give the same results in all inertial frames. Certainly, using the light postulate as well, one could then deduce that the Lorentz transformation relates the readings of different rods and clocks that have been constructed (by a similar process) in different inertial frames. However, one would still have deduced nothing about what happens when the same rod or clock is boosted (or accelerated) from one inertial frame to another. (As an example one might, in principle, envisage a theory satisfying the relativity principle and the light postulate, but with the additional property that once a rod or clock has been constructed in a given inertial frame it is destroyed by any subsequent arbitrarily small acceleration.)*" [7].

In conclusion, the 5th postulate of SRT was:
- not stated in Einstein's introductory text of SRT, however stated as a **postulate** in 1910.
- necessary to the conceptual structure of SRT.
- unproven experimentally, as again, there are no relativistic methods of comparison specified.

A very important note: the way Einstein defined a clock, in 1912-1914, proves that the time measured by the clock does not involve the concept of motion. Thus, the changes of the Z states of a clock do not involve space, or a change in space relative to the clock. The idea to be remembered from here is that the **physical time** and the **physical space** are separate concepts, even by Einstein's definitions.

2.6. Critical issues of the sixth postulate of SRT

- the 2nd postulate of synchronicity: the existence of a **common time** of different points in space.

• Einstein's words: "*But it is not possible without further assumption to compare, in respect of time, an event at A with an event at B.[...] We have not defined a common "time" for A and B*". (1905) [1]

The short phrase: "*We have not defined a common "time" for A and B* ..." simply indicates this postulate. It states that the physical reality must provide somehow a common time for two remote points of space (points which are identified in a coordinate system). It is hard to distinguish it from the next postulate, as both are connected linguistically in the same paragraph.

However, we agree that a postulate which requires the existence of a common time for different points of space would be needed in any theory of mechanics, classical or relativistic.

Therefore, our conclusions on the 6th postulate of SRT are straightforward, as it was:
- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- necessary to the conceptual structure of SRT.
- unproven experimentally, as it described the application of the fundamental concept of Time against aspects of another distinct fundamental concept which is Space (the physical 3-dimensional space).

2.7. Critical issues of the seventh postulate of SRT

- the 3rd postulate of synchronicity: the **unicity** of the method of synchronizing two clocks.

• Einstein's words: "*[...] a common "time" for A and B, for the latter cannot be defined at all unless we establish by definition that [...]*" (1905) [1]

The expression "... *cannot be defined at all unless* ..." shows clearly Einstein's restricting his theory to **only one manner** of defining time, and that manner was decided only by him, as he exclusively required the equality of times taken by light to travel on a round-trip between the remote points A and B.

We have already criticized extensively this postulate in a previous article, indicating the circular logic in which it is implied (see [9], pg. 4-6) along with the other assumptions of Einstein about synchronicity; those assumptions are in fact the other postulates of synchronicity described in this very article.

Therefore, we will only note here Einstein's failed attempt to justify this postulate in 1910. In his words:

"*To get a complete physical definition of time, we have to take an additional step: We have to say in what manner all of the clocks have been set at the start of the experiment. We will proceed as follows: First, we furnish ourselves with a means of sending signals, be it from A to B, or from B to A. This means should be such that we have no reason whatsoever to believe that the phenomena of signal transmission in the direction AB will differ in any way whatsoever from the phenomena of signal transmission in the direction BA. In that case there is, obviously,* ***only one way*** *of regulating the clock at B against the clock at A in such a manner that the signal travelling from A to B would take the same amount of time - measured with the clocks described above- as the signal traveling from B to A.*" [2].

Clearly, even in 1910 Einstein irrationally ***believed*** that the phenomena of signal transmission from A to B are identical to the phenomena of signal transmission from B to A. Unfortunately he was wrong, because: while the path A-B is identical to the path B-A for an observer at rest with the points A and B, the phenomena in the signals are independent from the system containing A and B, which means:

i.) - the electromagnetic phenomena are not at rest with the points A and B.
ii.) - the electromagnetic phenomena are **not dependent** on A and B, i.e. not bound physically to the

paths A-B and B-A. That means there is no law of Nature which makes the phenomena manifesting on A-B to be identical to the phenomena manifesting on B-A.

In conclusion, the 7th postulate of SRT was:
- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- necessary to the conceptual structure of SRT.
- irrational an illogical.
- unproven experimentally.

2.8. Critical issues of the eight postulate of SRT

- the 4th postulate of synchronicity: the **definition** of the method of synchronizing two clocks.

• Einstein's words: "*[...] we establish by definition that the "time" required by light to travel from A to B equals the "time" it requires to travel from B to A.*" (1905) [1]

Einstein made an obvious error in 1910 by claiming that it does not matter what kind of signal we choose:

"*For these signals we can use, for example, sound waves that propagate between A and B through a medium that is at rest with respect to these points [The medium must be at rest - or at the very least must not have any velocity component in the direction AB so that the paths AB and BA can be equivalent]. We can just as well use light rays propagating through the vacuum or through a homogenous medium at rest with respect to A and B.*" (1910) [2]

It is again puzzling to see how Einstein did not realize the error in the case of using sound signals in his method. If sound signals were to be used **inside** two ships moving from each other inertially, then his subsequent demonstration on the relative simultaneity would have failed lamentably, as the velocity of sound signals would be vectorially added to the velocity between the two systems considered. For more details, we recommend the reading of our considerations on "inertial synchronization" [9], [22].

This error of Einstein's 1910 text might indicate that he still did not realize the error he made in 1905 - when he used the variable velocities of light in different IRFs (see [9]).

Also, his condition that *the medium must be at rest* (with the points of an IRF) is **absurd** when applied to light in free space, as it implies that free space should be at rest with any inertial systems.

It is awkward to see how Einstein first claimed that his method works with different types of signals, and then immediately he admitted that his method might fail experimentally for different kinds of signals(!):

" *It does not make any difference whether we choose this or that kind of signals. If two kind of signals were to produce discrepant results, we would have to conclude that, for at least one the two kinds of signals, the condition of equivalence of the paths AB and BA was not satisfied.* ". (1910) [2]

Obviously, anyone can observe that *if two kinds of signals were to produce discrepant results* then it is possible that both kinds of signals failed Einstein's artificial condition of paths' equivalence.

As Einstein's method of synchronization was criticized in detail in our previous articles [9], [24], we can now conclude that the 8th postulate of SRT was:
- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- necessary to the conceptual structure of SRT.

- illogical.
- unproven experimentally.

2.9. Critical issues of the ninth postulate of SRT

- the 5th postulate of synchronicity: the **universal validity** of Einstein's definitions of synchronism.

  • Einstein's words: "*We assume that this definition of synchronism is free from contradictions and possible for any number of points;*" (1905) [1]

Let us quote directly what Wolfgang Engelhardt wrote about this postulate:

"*This seemingly innocent assumption was never justified by Einstein in detail, but following from the local time derived in §3 a severe problem appears to emerge. More than thirty years later, in Einstein's book with L. Infeld [6] a simplification is employed, which, intentionally or not, circumnavigates this issue.*" [10].

Further in his well-written article, Wolfgang Engelhardt analyses Einstein's considerations (of 1905) on the synchronism of clocks and the contradiction arising from that, using also Einstein's text written in 1938 in collaboration with Infeld - as Einstein's exemplification of the concept of "time dilation".

Thus, in the initial configuration proposed by Einstein, an IRF named S contains one clock in its origin which coincides with the origin of a different IRF named S' which also has its own clock. The system S is also "*equipped with three synchronized clocks at different positions x*".

In such configuration, Einstein explained the concept of time dilation without any apparent contradiction. However, as Wolfgang Engelhardt shows, Einstein's setting is a simplification which hides the problem of the relativistic Lorentz transformation for times. By placing in S' an array of clocks identical to the array of clocks which are all set to 0 at the moment t = t' = 0, we find out that such setting -easy to be confirmed in practice- proves the Lorentz transformation wrong, as the observers located in the origins of S and S' should see all the other pairs of clocks in S and S' in disagreement (according to Einstein's application of Lorentz transformation).

Practically Wolfgang Engelhardt proves that this 5th postulate of synchronicity (-by which Einstein assumed that his definition of synchronism was free from errors-) is actually wrong, as Einstein's definitions lead to errors which can be showed also in practice.

The findings of Wolfgang Engelhardt are confirmed by our computer simulations done for arrays of clocks in inertial motion [24].

In conclusion, the 9th postulate of SRT was:

- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- omitted in later SRT texts, which means it is still considered in effect, since 1905.
- necessary to the conceptual structure of SRT. It reinforces all other postulates of synchronicity.
- invalid logically.
- disproved experimentally. Any two arrays of clocks can be set up to show zero at the moment of setting their IRF's in motion from each other, or at the moment of coincidence of origins (reset).

2.10. Critical issues of the tenth postulate of SRT

- the 6th postulate of synchronicity: the **transitivity** of the method of synchronizing two clocks.

• Einstein's words: "*If the clock at A synchronizes with the clock at B and also with the clock at C, the clocks at B and C also synchronize with each other.*"

This postulate is important for SRT because it extends the concept of common time (the 2nd postulate of synchronicity) from two points of an inertial reference frame (IRF) to all the points of that IRF.
It is also stated in the 1910 and 1912-1914 texts:

"*[...] If, step by step, we regulate clock B against clock A, clock C against clock B ..., we obtain a series of clocks such that any of them is in phase with the preceding one.*" (1910) [2]

"*[...] we say that the clock at A is synchronized with the clock at O. Using the same procedure, clocks arranged at rest with other points B, C, etc., and of identical construction as the above mentioned clocks, can also be synchronized with the clock at O.*" (1912-1914) [3]

It is thus obvious that the 10th postulate of SRT was:
- stated explicitly in 1905's introduction, and in later texts of SRT, however not labeled as a postulate.
- needed by SRT, or by any theory involving measurements of time.
- valid logically.
- unproven experimentally for Einstein's method of synchronization.

2.11. Critical issues of the eleventh postulate of SRT

- the postulate of **multiple measurements** of the unique physical space.

• Einstein's words: - "*[...] light is always propagated **in empty space** with a definite velocity c [...]*".

- "*Let us **in "stationary" space** take two systems of co-ordinates, [...] to the origin of one of the two systems (k) let a constant velocity v be imparted in the direction of the increasing x of the other stationary system (K) [...] **We now imagine space** to be measured from the stationary system K by means of the stationary measuring-rod, **and also** from the moving system k by means of the measuring-rod moving with it*". (1905) [1]

The claim of this unverified postulate is twofold:

A.) - space is one unique physical entity.
B.) - space is measured differently from different inertial (coordinate) systems.

We observe the need of this postulate, in the already winding "logic" of the 1905 paper:

While -for the concept of Time- Einstein tried to prove that there are different times measured in different systems, he could not do the same for Space (i.e. there would be different spaces measured in different systems), especially in the course of the same demonstration.

In other words, while Time is (in Einstein's opinion) not a unique physical entity (probably because of his erroneous impression that time is given differently by different clocks), Space can be only one, and that needs to be postulated. Indeed, as he stated initially that light is propagated in empty space, it would have been difficult for him to break up the space **physically** for each moving system, and then later to attempt to relate those resulted spaces. Thus, he only needed to separate the measurements about space, which

measurements are to be done from different systems. Thus he implied (or allowed) that the measurements upon space can be different when done from different systems.

This postulate has propagated quietly through the discourse of the Special Relativity Theory as authored by various physicists in the last century. A good example is the affirmation of Pauli, who wrote in 1921:

"*there exist a **triply infinite set** of reference systems moving rectilinearly and uniformly relative to one another*" [14]

We have to mention with anticipation that this postulate is in conflict with the postulate of homogeneity of space and time, as it will be discussed further in the section 2.15.

In conclusion, the 11th postulate of SRT was:
- stated explicitly in 1905's introduction, and in later texts of SRT, however not labeled as a postulate.
- needed by SRT.
- invalid logically - in conflict with the 15th postulate which regards the homogeneity of space.
- unproven experimentally.

2.12. Critical issues of the twelfth postulate of SRT

- the postulate of the **chosen sign** attributed identically to the X axes of two systems.

  • Einstein's words: "*Let the axes of X of the two systems coincide*".

This postulate was stated by P.S.C. Bruskiewich in a peculiar way. He noticed the anti-symmetry of the formulae of Lorentz transformations attributed to each of two systems, but he incorrectly believed that the mere difference in sign of the above-mentioned formulae is a "third" postulate:

"*[...] to go from one equation in one frame of reference to an equation in the other frame of reference, the prime variables become un-primed and vice versa and the velocity merely changes sign. The Third of Einstein's postulate is evidently a heuristic postulate.*" [12].

While Bruskiewich' observation on the change of sign is correct "per se", the existence of that change of sign has a different cause: **the choice** which Einstein made by letting "*the axes of X of the two systems coincide*" [1].

Without this postulate, the standard form of Lorentz transformations cannot be determined. Practically this postulate dictates that one frame uses +v and the other frame uses −v in the standard algebraical form of Lorentz transformations. Thus, for two inertial systems S and S' we have:

• the Standard "direct" Lorentz transformation, applied in S about S' are:

$$\mathbf{x' = \gamma\,(x - vt)} \quad , \quad \mathbf{y' = y} \quad , \quad \mathbf{z' = z} \quad , \quad \mathbf{t' = \gamma\,(t - vx/c^2)} \quad , \quad \gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \qquad \mathbf{(1)}$$

• the Standard "inverse" Lorentz transformation, applied in S' about S, obtained by replacing **v** with − **v**:

$$\mathbf{x = \gamma\,(x' + vt')} \quad , \quad \mathbf{y = y'} \quad , \quad \mathbf{z = z'} \quad , \quad \mathbf{t = \gamma\,(t' + vx'/c^2)} \qquad \mathbf{(2)}$$

As we showed in our previous paper [13], if this postulate is annulled by the Principle of Relativity, both systems will obtain identical signs of v, and the Lorentz transformations will have a different form:

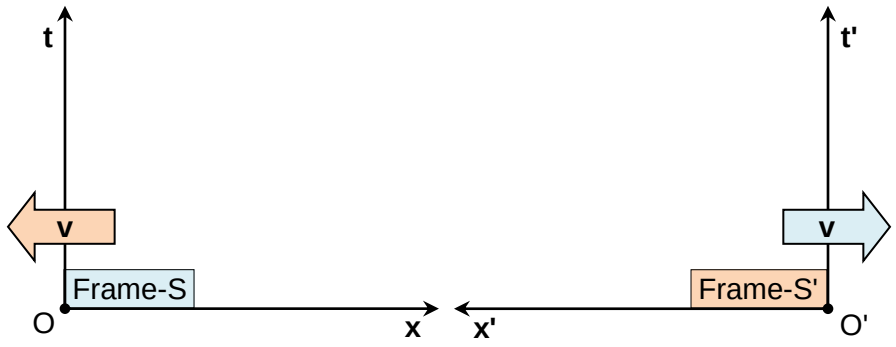

Fig. 1 - To respect the Principle of Relativity, the equivalent representation of the experiment **should** require **the origins O and O' of the systems to move** on the positive side **of respectively X and X'. As a result, the respective velocities measured in each system about the other system have the** same sign**.**

The non-standard "direct" LT applied in S about S':

$$\mathbf{x' = -\gamma\,(x - vt)} \quad , \quad \mathbf{y' = y} \quad , \quad \mathbf{z' = z} \quad , \quad \mathbf{t' = \gamma\,(t - vx/c^2)} \qquad \mathbf{(3)}$$

The non-standard "inverse" LT applied in S' about S:

$$\mathbf{x = -\gamma\,(x' - vt')} \quad , \quad \mathbf{y = y'} \quad , \quad \mathbf{z = z'} \quad , \quad \mathbf{t = \gamma\,(t' - vx'/c^2)} \qquad \mathbf{(4)}$$

As we can see, in the non-standard form of LT, each system applies the same equations in calculating the times and space coordinates of the other system. While this is a true relativistic form of LT, and suitable better for relativistic applications (if any - in reality no experiments were performed on two equivalent inertial systems), this form of LT makes it easier to determine the contradictions of the relativistic LT applications: mathematical contradictions, and contradictions in its applications in Electrodynamics. For more details about these issues, we recommend the reading of our article dedicated to them [13].

In conclusion, the 12th postulate of SRT was:
- stated explicitly in 1905's introduction and in later texts of SRT, however not labeled as a postulate.
- needed by SRT.
- invalid logically, as there no explanation on how and why a system gets "+" and the other gets "−".
- unproven experimentally.

2.13. Critical issues of the thirteenth postulate of SRT

- the postulate of **original coincidence** of two systems.

• Einstein's words: "*Let us in "stationary" space take two systems of co-ordinates [...]and issuing from a point*"."*[...]Let the axes of X of the two systems coincide*"."*[...]* $\tau(\mathbf{0},\mathbf{0},\mathbf{0},\mathbf{t})$ ".

The initial **coincidence of origins** of two coordinate systems and times has been used throughout all literature about the Special Relativity Theory, for more than a century. Yet it seems that nobody has noticed this peculiar demand of SRT: the existence of only one point of **agreement** in the histories of two different inertial systems.

There is no relativistic explanation on why the two systems are assumed to must have **one and only one point of agreement**, and how that point of agreement is established.

And so, the conclusions on the 13th postulate of SRT are immediate, as this postulate was:
- stated explicitly in 1905's introduction and later in all texts of SRT, however not labeled as a postulate.
- needed by SRT.
- invalid logically.
- unproven experimentally.

2.14. Critical issues of the fourteen postulate of SRT

- the postulate of **simultaneous validity** of Galilean transformation and Lorentz transformation.

• Einstein's words: "*[...] to the origin of one of the two systems (k) let a constant velocity v be imparted in the direction of the increasing x of the other stationary system (K) [...] To any system of values x, y, z, t, which completely defines the place and time of an event in the stationary system, there belongs a system of values ξ,η,ζ,τ, determining that event relatively to the system k, and our task is now to find the system of equations connecting these quantities.[...] If we place* ***x' = x - vt*** *, it is clear that* ***a point at rest in the system k must have a system of values x'****, y, z, independent of time.*"

Clearly, in Einstein's derivation of the Lorentz transformation ("*our task is now to find the system of equations*"), an observer attached to the moving system ***k*** is made to **believe** that the stationary system ***K*** is using the Galileo transformation to evaluate the location of the point x' of ***k*** (as seen in Fig. 2).

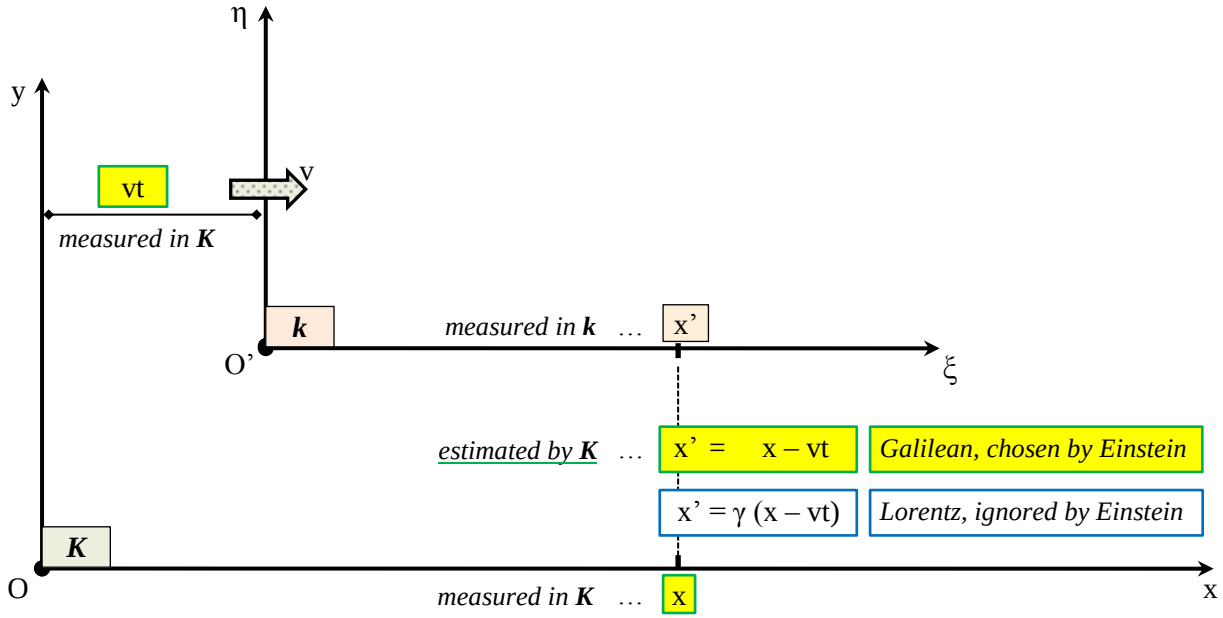

Fig. 2 - Einstein contradicted himself in the process of showing that the old mechanics (i.e. Galilean transformation) needs to be replaced by new mechanics, as he actually ignored the use of the "new" transformation, and instead, he chose to use the "old" Galilean transformation.

Obviously, Einstein's error was to consider ***x' = x - vt*** instead of ***x' = ℒ (x, y, z, t, v, c)*** ,where: ***ℒ (x, y, z, t, v, c)*** should be an **initially unknown** transformation of coordinates from ***K*** to ***k***.

As the goal of Einstein's reasoning was to find the form of $\mathcal{L}(x, y, z, t, v, c)$, it was illogical that he ignored the use of it in a situation when it was claimed that it would be in effect - as a law of Nature, assumed better than the old law of Galilean transformation.

The proof of Einstein's contradicting his own demonstration comes again from his text of 1910:

> "*If one **abandons** the ordinary kinematics and builds a new kinematics based on new foundations, one arrives at transformation equations different from those given above.*" [2].

Yet again, despite his claim of abandoning the Galilean kinematics, he immediately used them **instead** of his proclaimed newly built kinematics. Only this time, in 1910, he also abused the mathematics itself, as from:

" $x' = 0$ *and* $x - vt = 0$ "

he then proclaimed those equations to be linked by the expression:

" $x' = E(x - vt)$ "

where E was a constant, in his yet another assumption (i.e. postulate).

We can only conclude that: the 14th postulate of Einstein's SRT is an **absurd theoretical error**.

2.15. Critical issues of the fifteenth postulate of SRT

- the postulate of **homogeneity** of space and time.

• Einstein's words: "*[...] it is clear that the equations must be linear on account of the properties of homogeneity which we attribute to space and time.*" (1905) [1]

This assumption was perpetuated by many relativist authors thereafter. For instance, Pauli wrote in 1921:

"*[...] All writers start with the requirement that the transformation formulae should be linear. This can be justified by the statement that a uniform rectilinear motion in K must also be uniform and rectilinear in K'. Furthermore it is to be taken for granted that finite coordinates in K remain finite in K'. This also implies the validity of Euclidean geometry and the homogeneous nature of space and time.*" [14]

Later, in 1939, Per-Olov Löwdin attempted to obtain the Lorentz transformations "*without reference to electrodynamics and the properties of light [...], without reference to the velocity of light or group theoretical assumptions*" [15]. He literally stated the homogeneity of space as a distinct **postulate**.

However as showed in our previous article [9], the main error of this postulate is as follows:

The space is only one, and the distance between any two of its points is unique; therefore, any two IRFs will disagree on their measurements made for any particular distance between two arbitrary points of this space, as they measure such a distance **differently distorted** by the Lorentz transformations:

According to a well-known consequence of applying the Lorentz transformation, an object at rest in system S is measured as having the length L by an observer at rest in S. The same object is measured differently from system S': it will have a length L' contracted from L by the factor γ (which is described in the equations (1) above, in section 2.12.):

$$\mathbf{L' = L / \gamma'} \qquad \mathbf{(5)}$$

Another system S" will measure the object as having: $\mathbf{L" = L / \gamma"}$ **(6)**

And so on, there are an infinity of different values for L measured by the "*triply infinite set of reference systems* " mentioned by Pauli, as quoted above in section 2.11.

Another example, less known - yet very interesting, is described by Robert J. Buenker [16]: the observers in two IRFs will disagree on their measurements performed on the Y and Y' axes; that is, measurements performed "*along a direction that is **perpendicular** to their relative velocity*". He found that:

"*Because of time dilation in the rest frame of O', his proper clock is known to run* $\gamma = (1 - v^2/c^2)^{-0.5}$ *slower than those in the rest frame of O; thus, their respective clock readings satisfy the relationship,* $t' = t/\gamma$*, in all cases. The second postulate ensures that their respective values for the aforementioned distance can be obtained by multiplying the elapsed time on each clock with c. As a result, O finds that the distance is* $y=ct$*, whereas O' finds that it is* $y'=ct'$*. Because of the above relationship between their respective measured times, this means that*

$$\mathbf{y'} = ct' = c\,t/\gamma = \frac{\mathbf{y'}}{\boldsymbol{\gamma}}$$

However, this result stands in direct contradiction to the Fitzgerald-Lorentz length contraction effect (FLC) that Einstein derived on the basis of the LT [2]. The FLC states that

$$y' = y$$

because the direction is perpendicular to the relative velocity of the two observers." [16].

Thus, we can affirm: **without an agreement** on the measurements of space done by all observers, the homogeneity of space **cannot** be defined, as the properties of space (as a physical entity) cannot be defined to be the same by all the observers located in different IRFs.

This postulate is strongly related to the postulates of rigidity (the 3rd and 4th of SRT), and the postulate of multiple measurements of the unique physical space (the 11th of SRT) with which it is in contradiction.

In conclusion, the 15th postulate of SRT was:
- stated explicitly in 1905's introduction and later in several texts of SRT.
- needed by SRT.
- invalid logically, as it is contradicted by the application of Lorentz transformation for lengths.
- unproven experimentally.

2.16. Critical issues of the sixteenth postulate of SRT

- the postulate of **a system's time dependency on another system's time and space**.

• Einstein's words: "*We first define τ as a function of x', y, z, and t.*" (1905) [1]

This assumption that τ is a function of *x', y, z, and t* is completely unjustified. There was no reason (literally - no thought) put into assuming that τ can be physically related to either *x'*, or *y*, or *z*, or *t*, or any combination of them.

One of the most overlooked aspects of the inertial systems is the fact that they are **independent** from each other.

In Electrodynamics and Classical Mechanics, the physical phenomena which happen remotely from each other are **not always related causally**, therefore an attempt to relate forcefully their individual aspects, as in describing them as function of each other, is absurd, and here is why:

The mathematical relations of the Physics **before** the XXth century have not been established forcefully, as there were always experiments which sought to find what aspects are common to different phenomena, in order to be eventually related, or on the contrary, to be deemed as unrelated.

In the history of Mechanics, there has never been an experiment conducted with the purpose of relating the local observations **of time** done in one inertial system, to the remote observations of **time and space** done in another inertial system.

Thus, this postulate was a mere wish of Einstein to relate those variables in a convenient arrangement, in the hope that it will later support his many other assumptions and postulated guesses. Unfortunately, this unverified assumption was tacitly perpetuated by the Modern Physics with its lack of critical thinking.

In conclusion, the 16th postulate of SRT was:
- stated explicitly in 1905's introduction and later tacitly ingrained in all texts of SRT.
- needed by SRT.
- invalid logically and mathematically, as it is an enforced relation between different types of quantities.
- unproven experimentally.

2.17. Critical issues of the seventeenth postulate of SRT

- the postulate of **identical inertial speed** measured between inertial systems.

  • Einstein's words: - **a.)** "*[...] assuming equality of relative motion in the two cases discussed*". - **b.)** "*[...] a is a function $\varphi(\mathbf{v})$ [...]we introduce a third system of co-ordinates K [...] such that the origin of co-ordinates of system K moves with velocity $-\mathbf{v}$ on the axis of ξ* ". (1905) [1]

Per-Olov Löwdin declared this as a postulate in 1939, as he rephrased: "*space is symmetric with respect to velocities*" [15], however he did not explicitly cite Einstein's 1905 article.

More recently, in 2003, P.S.C. Bruskiewich named this postulate as "*Einstein's Fourth Postulate of Special Relativity*": "*It is understandable that the Lorentz transformation involves both **v** and **c** because these are the only velocities observers in the two frames of reference can agree upon.*" [12].

Indeed, it is clear that in this postulate, "space" is considered as being only one, and also that "space" provides an absolute property to both systems in motion from each other: the velocity **v**.

This assumption is even less explained than the second postulate of SRT, which, similarly, provides any inertial system with the magical ability of measuring always a constant speed of light ***c***.

As it happened with other postulates discussed here, this one had also been tacitly used by most of the texts of relativity, without being discussed even a bit. A possible explanation for such a blind adoption, in this case, could be that all the relativist physicists, including Einstein, misunderstood the identity of the inertial speeds measured from one system about the other. Thus, they did not realize that such identity can

be justified **only** in an absolute space. Mathematically, symmetry in space can only be defined if that space is only one and if that space is taken as an absolute reference.

Without a fixed reference (such as a physical entity with geometrical properties), the expression "*space is symmetric with respect to velocities*" is meaningless. We also have to mention that a **common time** must be composed with that space reference, in any procedure which would attempt to define symmetry for the composite concept which is velocity.

In conclusion, the 17th postulate of SRT was:
- stated explicitly in 1905 and later used in many relativistic derivations of the Lorentz transformation.
- needed by SRT.
- invalid logically and mathematically, as it involves an absolute space reference and a common time.
- unproven experimentally.

2.18. Critical issues of the eighteenth postulate of SRT

- the postulate of **transformation's unknown constant** as function of inertial velocity.

• Einstein's words: "*[...] **a** is a function φ(**v**) [...]In the equations of transformation which have been developed there enters an unknown function φ of **v**, which we will now determine.* "

Robert J. Buenker analyzed in detail the implications of Einstein's invoking of an unknown function $\varphi(\mathbf{v})$ in his calculations leading to the Lorentz transformation. The main issue is the fact that Einstein did not explain why the function φ depends only on the velocity $\mathbf{v}$.

As the $\varphi(\mathbf{v})$ function was used also in Einstein's text of 1910, and in the works of many other authors as **an assumption without any explanation**, our reproaches to it are similar to those which we stated in section 2.16. above, regarding the function $\tau(\mathbf{x', y, z, t})$:

It is obvious that functions such as $\varphi(\mathbf{v})$ and $\tau(\mathbf{x', y, z, t})$ were invented by Einstein, and then taken for granted by the relativists, without any logical explanation and without any experimental confirmation, only to fudge the mathematical calculations of the (relativistic) derivation of Lorentz transformation.

In conclusion, the 18th postulate of SRT was:
- stated explicitly in 1905's introduction and later taken for granted in other relativistic works.
- needed by SRT.
- invalid logically and mathematically, as it is an enforced relation between different types of quantities.
- unproven experimentally.

2.19. Critical issues of the nineteenth postulate of SRT

- the postulate of **post-acceleration mechanical equivalence** of any two arbitrary systems.

• Einstein's words: "*We now imagine the axis of the rod lying along the axis of x of the stationary system of co-ordinates, and that a uniform motion of parallel translation with velocity v along the axis of x in the direction of increasing x is then imparted to the rod. [...] Now to the origin of one of the two systems (k) let a constant velocity v be imparted in the direction of the increasing x of the other stationary system (K)*". (1905) [1]

Unfortunately, Einstein ignored the fact that a state of motion cannot be changed without involving acceleration, which means "*a uniform motion of parallel translation*" cannot be imparted to a system without accelerating that system. As there is no acceleration possible without forces applied, we can see that if a system is set in motion, it goes through a phase in which it is no longer an inertial system.

The big issue with this is that there is no experimental evidence to show that two identical systems, set in motion away from a third "stationary" system with respective different accelerations, will be able to perform identically all the experiments of Mechanics, Optics, and Electrodynamics. On the contrary, due to different internal energies accumulated in the respective acceleration phases, it is certain that some experiments of Physics will differ in the two systems, after the accelerations will have ceased [13].

Further in 1910, there was no improvement of this postulate, as Einstein **proclaimed** without any experimental proof, that: "*The laws governing natural phenomena are independent of the state of motion of the coordinate system with respect to which the phenomena are observed, provided that this system is not in accelerated motion*".

Interesting enough, in the same 1910 text, Einstein rejected the implication of the accelerated motion in his reasoning, by stating: "*[...]From now on we will consider only coordinate systems in nonaccelerated motion*" (see section §4, footnote, in [2]).
However, **he contradicted himself** in the section §5 of the same text: " *One accelerates the motion of an observer furnished with a measuring rod until he attains the velocity* ***v*** ".

The issue of acceleration being considered in the first demonstrations of the mathematical relations of SRT is crucial, because it is the generator of a multiple paradox:

• **unequal accelerations** applied to the ***k*** and ***K*** systems (in Einstein's demonstration) will render them nonequivalent. That means, one of them will be **privileged** - and that will require valid explanations on "why an inertial system has to be always privileged and preferred over all the other inertial systems".

• **equal accelerations** applied to the ***k*** and ***K*** systems will imply, after the Lorentz transformation is derived, that both systems calculate about each other's space and time exactly the same values, but neither value equals what each of them actually measures within its own coordinate system.

In other words: unequal accelerations will solve the asymmetrical clocks paradox (known also as the "twins paradox") while contradicting the Principle of Relativity which claims that the same laws of physics are valid in two different inertial frames. On the other hand, equal accelerations can be ignored from the demonstration of SRT, but in this case, SRT implies the symmetrical clocks paradox - which is a mathematical contradiction, without any logical solution based on the physical reality [13].

In conclusion, the 19th postulate of SRT was:

- stated in Einstein's introductory text of SRT, however not labeled there as a postulate.
- re-stated in subsequent SRT texts.
- the absence of this postulate is contradictory to the first postulate of SRT.
- the presence of this postulate is fundamental for the symmetrical clocks and lengths paradoxes.
- invalid logically.
- disproved experimentally: two systems equally accelerated do not require the Lorentz transformations, while two systems unequally accelerated are nonequivalent and therefore present different Physics, and that renders the Special Relativity Theory as incorrect and unnecessary.

3. Conclusions

The number of postulates used by Einstein in his 1905 article is disturbingly enormous. Thus, Einstein's introduction of Special Relativity Theory imperatively demanded from the physical reality that:

1. All laws of physics must be the same in all inertial systems.
2. Velocity **c** must be immutable.
3. Velocity **v** must be immutable.
4. Length units must remain constant in time, for bodies at rest.
5. Length units must remain identical in all IRFs.
6. Time units must remain identical throughout all space.
7. There must be a common time for different points of space.
8. There must be only one method of synchronizing clocks.
9. To synchronize clocks one must use only light's roundtrip guessed times between two points of an IRF.
10. The abovementioned definition of synchronizing clocks must be universally valid.
11. The abovementioned definition of synchronizing clocks must be transitive.
12. Space must allow multiple disagreeing measurements.
13. Space must be one, and homogeneous before LT is derived, and inhomogeneous afterwards.
14. Any calculation of Lorentz transformation (LT) must assume the same sign for the X axes.
15. Any calculation of LT must assume the same origins of time and space coordinates, only once.
16. Any calculation of LT must assume the initial validity of Galilean transformation and then discard it.
17. In Einstein's calculations of the derivation of LT, $\boldsymbol{\tau}$ must be a function of **x'**, **y**, **z**, and **t** .
18. In Einstein's calculations of the derivation of LT, $\boldsymbol{\varphi}$ must be a function of **v** .
19. Any two inertial systems must be mechanically equivalent regardless of their history of accelerations.

The above list of Einstein's demands to the physical reality has been compiled from all the 19 postulates which he used in his works since the introduction of Special Relativity Theory, as described in details by this present document.

Although it is obvious in the 1910 and 1912-1914 papers of Einstein that he attempted to simplify or to replace some of his initial statements made in 1905, most of the nineteen postulates were still either tacitly assumed, or, if re-stated, worse justified than in 1905.

As for the works of other physicists who attempted different relativistic derivations of Lorentz transformations, it is obvious that they either used many of Einstein's 19 postulates, or they replaced them by other much-needed assumptions - which in the end count as postulates.

We consider that any theory which is based on such an enormous number of postulates is invalid and unacceptable for the science of Physics. At this point in the history of Physics, more than a century after SRT was introduced, we affirm that the efforts for replacing SRT by a better theory are imperative, as now it is impossible for the science of Physics to progress away from such hallucinating grounds.

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