

Special theory of relativity in a three-dimensional Euclidean space

Amrit Sorli^{a)}, Davide Fiscaletti^{b)}

Space Life Institute, Gorenja Trebuša 79, Slap ob Idrijci 5283, Slovenia

(Received 5 October 2011; accepted 13 January 2012; published March 2012) Physics Essays – AIP

<http://physicsessays.org/>

Abstract: In the 20th century, physics has understood space and time as being coupled into a “space-time” manifold, a fundamental arena in which everything takes place. Space-time was considered to have three spatial dimensions and one temporal dimension. Out of the experimental facts one can conclude that time t we measure with clocks is only a numerical order of duration of motion, i.e. material change in a three-dimensional space. This view allows description of electromagnetic phenomena in a three-dimensional Euclid space.

Résumé: Au cours du 20^{ème} siècle, la physique comprenait l'espace et le temps comme étant jumelés en “espace-temps” variés, une arène fondamentale où tout prend place. On croyait espace-temps avoir trois dimensions spatiales et une dimension temporelle. A partir des données expérimentales on peut conclure que le temps t - mesuré au moyen d'horloges – n'est qu'un ordre numérique de durée de motion, c'est-à-dire changement matériel dans un espace tridimensionnel. Ce point de vue rend possible la description de phénomènes électromagnétiques dans un espace d'Euclide tridimensionnel.

Key words: space-time, space, time, numerical order of motion, photon.

I. RELATIVE VELOCITY OF MATERIAL CHANGE IN A 3D EUCLID SPACE

Experimental data confirm that a photon has constant velocity in all inertial systems. Its motion in inertial systems o and o' can be described within Euclidean space, with Galilean transformations for the three spatial dimensions and Selleri's transformation for the numerical order t of material changes. The Galilean transformations

$$\begin{aligned}X' &= X - v * t \\ Y' &= Y \\ Z' &= Z\end{aligned}\tag{1}$$

^{a)} sorli@spacelife.si

^{b)} fiscaletti@spacelife.si

are valid for both the observers O and O' in inertial systems o and o'. Let a moving inertial system o' observed from rest system o move with respect to the inertial system o with constant velocity $v < c$ parallel to the X axis. The transformation of the speed of clocks given by Selleri's formalism:^{1,2,3}

$$t' = \sqrt{1 - \frac{v^2}{c^2}} * t \quad (2)$$

shows clearly that the speed of the moving clock does not depend on the spatial coordinates but is linked only with the speed v of the inertial system o'.

In the formalisms (1) and (2), time and space are two separated entities. Equations (1) and (2) determine an arena of Special Relativity in which the temporal coordinate must be clearly considered as a different entity with respect to the spatial coordinates just because the transformation of the speed of clocks between the two inertial systems does not depend on the spatial coordinates. Selleri's results seem thus to suggest that the three spatial coordinates of the two inertial systems turn out to have a primary ontological status, define an arena that must be considered more fundamental than the standard space-time coordinates interpreted in the sense of Einstein. On the basis of equations (1) and (2) we can conclude that the real arena of Special Relativity is not a mixed 3D+T space-time but rather a 3D space where time does not represent a fourth coordinate of space but must be considered merely as a mathematical quantity measuring the numerical order of material changes. A clock as a measuring device of numerical order of material change in an experiment runs slower (generally, all material changes run slower) in a faster inertial system o' than in an inertial system at rest o. Experiments with clocks in a fast airplane do confirm that these relative velocities are valid for both observers O and O'.⁴

II. TIME DILATATION AND LENGTH CONTRACTION

In this formalism (1) and (2) there is no "time dilation" as it is known in Special Theory of Relativity. It is not true that dilation of time as a 4th coordinate of space causes clocks to have a slower rate. What really exists in different inertial systems is relative velocity of material change (including run of clocks).

There is also no "length contraction" in the direction of motion of an inertial system along the axis X. Regarding "length contraction" some other research leads to the same conclusions. Since 1905 when Special Theory of Relativity was published there has been no experimental data on "length contraction".⁵

III. LIGHT CLOCKS CONTRADICTION

Let us take two "light clocks" where a photon moves between two mirrors. One path of the photon between mirrors means one "tick" of the clock. In a moving inertial system o' we put one light clock A horizontally in the direction of motion along the axis X and another light clock B vertically with respect to the axis X. According to the "length contraction" clock A should shrink and so photon would have a shorter

path and clock A would “tick” faster than clock B. Special Theory of Relativity does not predict that two clocks in the same inertial system should have a different rate.

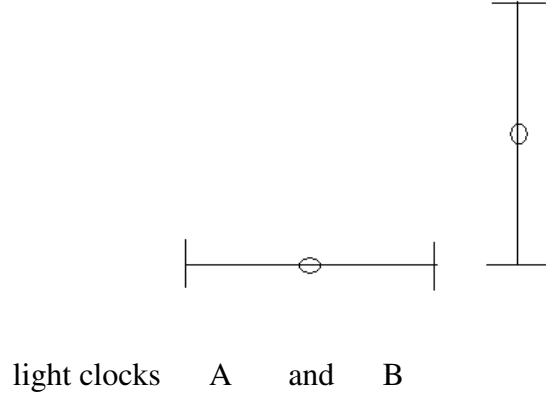


FIG.1. Horizontal light clock A and vertical light clock B in a moving inertial system

In virtue of the constancy of light speed (stated by the second postulate of Special Relativity) the vertical light clock B and the horizontal light clock A should have the same rate. According to the authors of this article, the “length contraction” of horizontal light clock A creates therefore a paradox. The contradiction between the results of the vertical light clock and the horizontal light clock suggests that there should be no “length” contraction along the axis X into direction of motion. To resolve this paradox, here the authors propose that Minkowski’s 4D space with coordinates X_1, X_2, X_3, X_4 must be replaced with a 3D Euclid space with the Galilean transformations (1) for the spatial coordinates and Selleri’s formalism (2) for the transformation of the speed of clocks. On the basis of equations (1) and (2), in the arena which describes electromagnetic phenomena, time is a distinct entity from space (it is only a mathematical quantity indicating the numerical order of material changes) and there is no “length contraction” of moving light clocks. Vertical light clock B and horizontal light clock A have the same rate. The 3D Euclid space characterized by equations (1) and (2) allows us to resolve in a clear and elegant way the light clocks paradox.

IV. ABOLISHING OF SPACE-TIME AS A FUNDAMENTAL ARENA OF THE UNIVERSE DOES NOT REQUIRE INTRODUCTION OF MODERN CONCEPTS OF “ETHER”

According to the view here proposed abolishing of time t as a 4th dimension of space and space-time as a fundamental arena of the universe does not require introduction of modern concepts of “ether” as proposed by Levy, Duffy and some other researchers.⁶ The concept of a three dimensional quantum vacuum composed out of fundamental entities having the size of Planck volume l_p^3 where time t is a numerical order (numerical sequence) of material change has more explanatory power and is a more adequate model of the three-dimensional physical space as a modern concept of “ether” whose energy content is dominantly electromagnetic in nature. Physical space does not behave as a medium which carries

the light, but instead the propagation of light is governed by the electromagnetic properties of the quantum vacuum, its permeability and permittivity. Reintroduction of “ether” is not necessary as quantum vacuum covers all its properties.

In his article *Ether theory and the principle of relativity*,⁶ Levy has derived a set of space-time transformations which assume the existence of a preferred ether frame and the variability of the one-way speed of light in the other frames. In Levy’s approach, the extended transformations can be converted into a set of equations that have a similar mathematical form to the Lorentz-Poincaré transformations, but which differ from them in the sense that they connect reference frames whose coordinates are altered by the measurement distortions due to length contraction and clock retardation and by the synchronization procedures. Instead, in the view proposed by the authors of this article, the transformations of spatial coordinates (1) and of time (2) imply the following fundamental results: on one hand, that there is no length contraction along the direction of motion of an inertial system and, on the other hand, that time is a distinct entity from space and that the idea of dilation of time can be replaced with the idea of relative velocity of material changes (including runs of clocks) in different inertial systems. The fundamental arena of special relativity is indeed a 3D Euclid space subjected to Galilean transformations for the three coordinates of space and where time exists only as a mathematical parameter measuring the numerical order of material changes: in each inertial system there is a peculiar velocity of material changes. The view here suggested presents Einstein’s special relativity in an ordinary way without unnecessary introduction of the imaginary coordinate $X_4 = ict$. In the universe time as a 4th dimension of space does not exist and so could not be “relative”. With clocks we measure velocity and duration of material change; relative is a velocity of material change running in a three-dimensional physical space which originates in a three-dimensional quantum vacuum.

V. CONCLUSIONS

Introduction of Minkowski four dimensional space into physics has created a century long misunderstanding that time is a spatial dimension although there is no experimental data for such interpretation of time. With clocks we measure time as a numerical order of motion, i.e. change in a three dimensional universal space; time exists as a mathematical quantity independently of the measurement by the observer. Universal changes have their numerical order and this is what time is. Electromagnetic phenomena can be satisfactory described within three dimensional Euclid space and time as a numerical order of their motion.

Acknowledgement:

The authors wish to thank Erik Margan for his advices and encouragement.

¹ F. Selleri, “Space and time should be preferred to spacetime – 1”, *International workshop Physics for the 21st century*, 5-9 June 2000.

² F. Selleri, “Space and time should be preferred to spacetime – 2”, *International workshop Physics for the 21st century*, 5-9 June 2000.

³ R. Manaresi and F. Selleri, Found. Phys. Lett. **17**, 65 (2004).

⁴ A. S. Sorly, D. Fiscaletti and D. Klinar, Physics Essays **24**, 2 (2011).

⁵ B. L. Lan, Physics Essays **24**, 293 (2011).

⁶ M. Duffy and J. Levy eds., *Ether space-time & cosmology*, (Apeiron, Montreal, 2009), Vol. 3.