TIME DILATION CONTRADICTS THE RELATIVITY PRINCIPLE

MARAT VLADIMIROVICH GURYEV

Shipilovskaya St., 62/1-172, 115682-ru, Moscow

Russian Federation

e-mail: mvguryev@mail.ru

Abstract

Standard relativistic physics has been validated by numerous experiments; therefore, we can criticize only verbal interpretations. Lorentz contractions (LC) of four coordinates are widely accepted as both real and fundamental phenomena. Time dilation (TD) is a special case of LC. TD is generally interpreted as the real change of time. This article shows that TD, if it exists, contradicts the relativity principle (RP), which subsequently implies that the concept of TD has no physical meaning. Unfortunately, this simple fact has gone unnoticed until now. This article shows that known simple relativistic measurements were erroneously interpreted as a "test of TD" when, in reality, researchers were testing relativistic formulas for the Doppler Effect (DE). Apparently, the results of these "measurements," which are known as the "twin paradox" (TP) turned out to be disinformation that was put forth to hide the fact that TD contradicts the RP.

1. Introduction

The theory of standard relativistic physics (SRP) (see, e.g., [1, 2]), has been validated by numerous precise experiments, including atomic spectroscopy, quantum electrodynamics (QED) [3], and the theory of accelerators [4]. Here, we will work only with the inertial motion of relativistic objects.

Notably, the QED of atoms and molecules is the most precise theory ever developed by humankind. This implies that the results of calculation methods for SRP coincide well with the results of corresponding experiments. We can say that SRP describes reality well - that is, SRP is correct science.

Therefore, we can only criticize verbal interpretations of various results of calculation methods but not the methods themselves. Lorentz contractions (LC) are the simplest results of relativistic calculations because they are direct consequences of Lorentz transformations. It is convenient to use time dilation (TD) as an example of LC.

We must insist that SRP is correct science; nevertheless, the problem of TPs exist. We must recall that this problem is a direct consequence of the generally accepted hypothesis of the reality of TD.

Because no one drew attention to the obvious connection between TD and TP, we must consider this issue, even if it has no real physical meaning.

The goal of this article is to prove that the widely spread assertion of the reality of TD is a crude mistake because TD contradicts the relativity principle (RP). Incidentally, we will solve the TP.

The remainder of the article is organized as follows: In Section 2, we will consider TD, RP and TP in detail; in Section 3, we will consider the trials of TD measurement; and Section 4 is a conclusion devoted to the reasons for the fundamental mistakes found.

2. TD, TP and the RP

The simple definition of TD is given as follows: "A clock moving uniformly with velocity v through an inertial frame S goes slower by factor $\frac{1}{\gamma} = \sqrt{1 - \frac{v^2}{c^2}}$ relative to the synchronized standard clocks at rest in S" [1]. We can consider this text as the standard because similar definitions are given in many relativistic textbooks.

This definition implies that TD is accepted as a real phenomenon of change of time because of the relative motion of the object and observer.

However, this definition contradicts the RP, which states that the relative inertial motion of an object and an observer must not influence the time of either the object or the observer. This contradiction to the RP implies that the concept of TD has no physical meaning.

No one has drawn attention to this contradiction until now. Instead, many physicists were keen on TP, which represents the direct consequence of TD. The problem with TP appeared nearly simultaneously with SRT and was well considered in [5].

Unfortunately, this problem remains. Discussions about TP are widely spread, even reaching Wikipedia. Almost every previous author who has investigated this issue was sure that he/she had solved TP; yet, incorrect information continued to spread for hundreds of years. I assume that we should acknowledge that discussions about TP are merely dead work.

No one drew attention to the truth - that the existence of TP is merely a bold hypothesis and that TD actually exists as a real property of time that is influenced by the relative inertial motion of the object and the observer. Let us recall that the concept of TD contradicts RP.

The obvious reason for this situation is the general assurance that TD and the usual differences of time can be measured. This assurance follows

the erroneous interpretations of corresponding experiments. Therefore, we should consider certain experiments, which were usually interpreted as measurements of TD, as shown in the next section.

3. Measurements of Time Dilation

We will firstly consider an experiment conducted by [6]. The authors of [6] claimed that they had carried out a "test of TD." However, if the reader carefully reviews the first page of [6], he/she will see that these authors measured "four laboratory frequencies" of different light rays but not changes in time. The authors multiplied these frequencies and achieved a result that corresponded to DE theory within SRP. Therefore, they proved the correctness of SRP and nothing more. Notably, these authors made this conclusion but failed to notice that they had merely measured frequencies and used them for confirmation of the relativistic theory of the DE.

In another example of a "measurement of TD", TD was used as a relativistic correction in calculations of GPS work, which works quite well. Such arguments relate to all the results of SRP calculation methods but not to TD, which is merely an intermediate result of relativistic calculations. We have no right to assign physical meaning to one part of a calculation that has been extracted from a complete method.

However, there are other possible "measurements" of TD. A generally accepted and incorrect notion consists of the following: Authors have claimed to have measured TD via measuring changes in the observable decay frequency of cosmic muons. This change was boldly interpreted as a change in the time of muon motion; however, it was merely a display of the relativistic DE.

4. Conclusion

If we want to obey reality, we should change the text given above as the definition of TD as follows: "A clock moving uniformly with velocity v

through an inertial frame S seems to tick slower by factor $\dfrac{1}{\gamma}$ relative to the synchronized standard clocks at rest in S." I remind the reader, for example, that the well-known relativistic formula from [1] for DE in usual definitions can be written as $\omega_0 = \left(1 + \dfrac{v}{c}\cos\alpha\right)\gamma\omega$. This formula is different from the non-relativistic one by the standard relativistic factor, v, which also distinguishes Lorentz transformations from Galilean transformations.

Therefore, we should acknowledge that TD (and all LCs) are mere relativistic corrections of four coordinates within SRP. Although all of us dream of discovering new and fundamental phenomena, by following Einstein, we must accept TD (and all LCs) as real because this hypothesis means that we can control time and all other coordinates. Such an opportunity is fundamental and quite pleasant.

Therefore, we should be cautious when using fundamental words in physics.

References

[1] W. Rindler, Relativity - Special, General and Cosmological, 2nd Edition, Oxford, 2006.

[2] V. B. Berestetskii, E. M. Lifshitz and L. P. Pitaevskii, Quantum Electrodynamics, 2nd Edition, Elsevier Ltd., 1982.

[3] I. P. Grant, Relativistic Theory of Atoms and Molecules, Springer Science+Business Media, New York, 2007.

[4] D. A. Edwards and M. J. Syphers, An introduction to the physics of high energy accelerators, Wiley, 1993.

[5] C. Møller, Theory of Relativity, Clarendon Press, Oxford, 1972.

[6] B. Botermann et al., Test of time dilation, using stored Li+ ion as clocks at relativistic speed, Phys. Rev. Lett. 113 (2014), 120405.