Is time dilation a real physical nature of time?

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Abstract

In the current physical literature, there are many articles discussing the physical nature of time, in which time dilation is a controversial aspect of time. In this article we will search to see how physicists have come the elusive concept of time dilation and try to confirm whether it is a real physical process or only an observational phenomenon.

1. The increase of lifetime of high speed muons.

Two following phenomena are often mentioned in the literature to demonstrate that time dilation is a real physical nature of time:

1/ Experiments performed at CERN showed that muons at speed of 0.99 c were found to have an average lifetime 29 times as large as that of muons at rest.

2/ The finding of muons at sea level by Seth Neddermeyer in 1936 proved that because of their high speed (0.999 c), their lifetime has physically increased from 2 μs to 30 μs so that they can in fact travel over 9000 m instead of 600 m, and thereby they can reach the sea level.

From these data, physicists of modern physics believe that time dilation is no doubt a real physical phenomenon.

But Guido F. Nelissen, in his article "Physical Nature of Time" (2019) came to an inconclusive view on the time dilation: it still remains as a question.

"From this we must conclude that, roughly a hundred years after its publication, the ambiguity about the physical nature of time and the time dilation has not yet been properly cleared out and that therefore the question remains whether time dilation is a genuine physical process or an observational phenomenon?"

That is, Nelissen has not made a final decision on the physical nature of the time dilation. In the following sections we will present our viewpoint on whether or not the time dilation is a real physical process.

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(1) This section is a brief extraction about time dilation from the article "Physical Nature of Time" of Classical Physics by Guido F. Nelissen, published in May 2019 at the website www.viXra.org:1905.0398; page 4.
The purpose of this article is to present the viewpoint of the author that the time dilation does not exist physically although the lifetime of a moving muon does increase with its velocity.

2. The muon is a version of the electron

First, let's define the average lifetime of the muon ($\mu^-$):

The muon is created when the pion ($\pi^-$) decays: $\pi^- \to \mu^-$, and after a very short time, the muon decays into the electron: $\mu^- \to e^-$. The lapse of time between these two events is the average lifetime of the muon: $\tau \approx 2.2$ μs.

When physicists observed the increase of lifetime of relativistic muons (at CERN and at sea level), they thought this is because "time dilates". But this increase of elapsed time can be explained by a new theory: the variability of the electric charge of the muon by its velocity and the applying field also causes its lifetime to change. In this case, the concept of time dilation becomes unnecessary or useless: it may be replaced by a new concept.

The new theory of the extended electron has been presented in a series of articles in the website www.viXra.org/author/hoa_van_nguyen. It presents the following new concepts in the link between the electron and muon:

The muon (like the electron) is an extended particle with internal components, not a mere point charged particle. It is the same particle as the electron: $\mu^-$ has the same mass as the $e^-$ but its electric charge is much lower when it is created: $e_{(\mu)} = 7.74 \times 10^{-22}$ C while the electric charge of the electron is $e = 1.602 \times 10^{-19}$ C.

This means that muon is a version of the electron with reduced and varying electric charge: the muon differs from the electron by its electric charge, not by its mass. Due to its reduced electric charge, muon is much more penetrating into matter than the electron. This new idea is evidently contrary to the mainstream concept of modern physics except that it is like an electron almost every way.

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(2) "The muon is a mystery; it is like an electron almost every way but its mass. There is no known reason why it must exist..." (Lehrmann & Swartz, Foundation of Physics, 1969, p.697)

"Muons even today represent something of a puzzle... Only in its mass and stability does the muon differ significantly from the electron, leading to the hypothesis that the muon is merely a kind of 'heavy electron' rather than a unique entity.” (A.Beiser, Concept of Modern Physics, 1981)

(3) The tau particle $\tau$ is analogous to muon: it is a version of the electron; i.e., it has the same mass as the electron but its charge is much reduced: $e_{(\tau)} = 0.46 \times 10^{-22}$ C, and hence it is potentially highly penetrating, much more than electrons (Wikipedia Encyclopaedia).

Please read section V of Ref.[3]: if we renormalize the electric charge of the electron, instead of renormalizing its mass, we will get the reduced charges of muon and tau particles: $e_{(\mu)}$ and $e_{(\tau)}$, as shown above.
3

The physical reason for this is that the electric charge of the electron is an effective one which is a function of its velocity and the applying field \[^{[2]}\] according to the equation

\[
q = \gamma^{-N}q_0 \quad \text{or} \quad q = (1 - \frac{v^2}{c^2})^{N/2}q_0
\]

where \( \gamma = (1 - \frac{v^2}{c^2})^{-1/2} \) is the Lorentz factor, \( q_0 \) is the electric charge of the electron at rest; i.e., \( q_0 \equiv e \), and the real number \( N \geq 0 \) representing the applying field (electric or magnetic). Fig. 1 shows the graph of Eq. (1) plotted by computer.

![Graph](image)

\[
\text{Fig.1 : } \quad \frac{q}{q_0} = (1 - \frac{v^2}{c^2})^{N/2}
\]

The graph shows that the higher the velocity and/or the stronger the applying field \( N \), the lower the effective electric charge of the electron, and as \( v \to c \), \( q \to 0 \) (for \( N \geq 2.0 \)).

We will use this chart to explain the changes of the lifetime of the muon in different external applying fields \( N \).

**3. Why the lifetime of the muon increases with its velocity?**

When the muon is created, its velocity is near \( c \) (\( \approx 0.99 \ c \)) and its charge \( q \) very low (\( \approx 7.74 \times 10^{-22} \text{ C} \)). So the representing point \( M \) of the muon lies on the lower right end of one of the curve in Fig. 1 (for example, the red curve \( N = 2.0 \)). After being created, the muon
slows down and stops in the medium of the detector: the representing point $M$ moves on the same red curve to the origin point ($v/c = 0, q/q_0 = 1.0$) (upper left end) which represents the electron at rest; that is, the muon becomes the electron. The lapse of time between two events (decays: $\pi^- \rightarrow \mu^-$ and $\mu^- \rightarrow e^-$) is the average lifetime of the muon: $\tau = 2.2 \mu s$.

Now, since the creation of the muon may occur in different physical conditions on velocities and fields (as in the lab at CERN or in the atmosphere), the representing point $M$ of the muon thus can lie on any curve $N$ of the graph in Fig.1, and therefore it moves to the origin point in different lapses of time. This elapsed time is needed for the muon to be transformed into the electron. Therefore, the lifetime of the muon changes with its velocity and with the field in which it is created.

**Conclusion:**

Therefore, by using the new concept of the variability of the electric charge of the electron (as described by Eq.(1) and Fig.1), we can explain the changes of the lifetime of the muon with its velocity and applying field **without the need of the concept of time dilation**.

Time does not dilate nor shrinks: it is absolutely invariant as conceived by Newton. The concept of time dilation leads to counter intuitive ideas of "length contraction" and the so-called "twin paradox": both ideas are old-fashioned and superfluous for the modern physics.

In previous articles $[^3]$ & $[^4]$ we used the concept of variability of the electric charge of the electron to explain the mystery of the mass of the muon and the generation of anti-particles of Dirac and more. The theory of the extended electron will provide a new prospect for the modern physics, which physicists used to call "new physics".

**References**

The theory of the extended model for the electron is presented in a series of articles at the website [www.viXra.org/author/hoa_van_nguyen](http://www.viXra.org/author/hoa_van_nguyen); including:


[2] Electron’s mass and electric charge, which one changes with velocity? (viXra: 1304.0066)
