Velocity of cosmic muons most likely much higher than *c*

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Abstract- It seems to be the most attractive experiment for physicists, who strongly believe in the validity of the STR, to refer to: the supposed half-life time, in combination with their supposed velocity, of muons entering the atmosphere. The crucial part of the experiment is the application of the equation $E=mc^2$. This article shows that, by applying this equation, the one error in STR is used to prove the apparent validity of another error in this theory.

Introduction

The word muon is the abbreviation of the meant particle: μ-meson. In 1963 David H. Frisch and James H. Smith published an article in the American Journal of Physics with the title: Measurement of the Relativistic Time Dilation Using μ-Mesons [1]. The abstract starts as follows: " An experiment has been performed to demonstrate the relativistic time dilation as a large effect.....". The mentioned large effect is attributed to the supposed velocities of the muons, being almost ***c.*** As a result the STR prescribes large time dilations, which are supposed to influence the half-life time of the muons with the same order of magnitude.
The above mentioned article is taken as reference to dispute the claimed evidence that such an experiment proves the validity of the phenomenon time dilation, as predicted by STR.

Fundamental assumption

The argumentation of the authors, regarding the claimed similarity between clocks and the half-life time phenomenon, sounds:

> "As far as we know the probability of the radioactive decay of subatomic particles, and thus the average time they survive before decaying, is set by forces entirely internal to their structure. Therefore, *any dependence of the decay probability of radioactive particles on their speed is an example of a general property of clocks in motion relative to an observer* rather than a property of the speed of these particular particles relative to anything else in the universe. It is irrelevant, for example, that up to the present era the observer has happened to be on earth."

Crucial in this argumentation is the following reasoning:

> "*any dependence of the.....on their speed is an example of a general property of clocks in motion relative to an observer.....*"

So firstly they take for granted, most likely based on the outcome of the STR, that clocks in motion have a "general property" and that this property only depends on the speed relative to the observer.

Expressed in simple words: each observer, having a different speed relative to the observed clock than another observer, will read a different time on that same clock. Conclusion: each observer does have its own influence on the frequency of the clock, only depending on the relative motion between clock and observer. Any reference "else in the universe" does not have influence on the frequency of the clock, as they state!

If we would exclude physical influence of (the speed of) any observer on the behaviour of the clock, and thus that the clock will not change its frequency as a function of the speed between observer and clock, then the only conclusion is left that the observer is, in some way or another, influenced by the mutual speed between clock and observer. See [2] section 7 for a critical consideration of the "STR-observer".

Secondly the authors claim that the decaying of muons is an example of the just described interaction between observer and observed clock.

N.B. These truly science fiction-like fundamentals are taken as the basis for the experiment to be carried out!

Measurement of the speed of the muons

The speed of the muons is calculated from their measured energy. The only kind of energy of an object from which its velocity can be calculated is the kinetic energy.

In stead of using $E_k = \frac{1}{2}mv^2$, the authors took the energy prescribed by the STR: $E = m_r\boldsymbol{c}^2$, with m_r the relativistic mass $m_0/\sqrt{(1-v^2/c^2)}$. m_0 is the so called 'in-rest-mass'.

Let us abbreviate $1/\sqrt{(1-v^2/c^2)}$ to γ, as is normally done. So $m_r = \gamma m_0$ and $E = \gamma m_0\boldsymbol{c}^2$.

By measuring E in terms of the so-called 'in-rest-energy' $m_0\boldsymbol{c}^2$, γ will have values starting at 1 and higher. The velocity can now be calculated from these measured values of γ.

Reference [3] argues why $E=m\boldsymbol{c}^2$ is a self-evident non-physical equation.
Therefore now the equation $E_k = \frac{1}{2}m_0v^2$ is taken in stead of $E= \gamma m_0\boldsymbol{c}^2$, using the same measured energy E. So E_k is taken as the real measured E.
Writing E_k as $\frac{1}{2}m_0\boldsymbol{c}^2 * (v^2/\boldsymbol{c}^2)$, shows that $E_k/m_0\boldsymbol{c}^2 = \frac{1}{2}\, v^2/\boldsymbol{c}^2$ in genuine physical terms.

In the experiment the outcome of the measurement of the energy E, in terms of $m_0\boldsymbol{c}^2$, is a dimensionless number, from now on indicated as γ_m, because $\gamma_m = E/m_0\boldsymbol{c}^2$.

In the experiment under consideration the speed of the muons is calculated from this γ_m, applying $1/\sqrt{(1-v^2/c^2)} = \gamma_m$, so the outcome is, by definition, not higher than $\boldsymbol{c}$.

However if this γ_m is used to calculate the speed of the muons by applying $\frac{1}{2}\, v^2/\boldsymbol{c}^2 = \gamma_m$, then an arbitrary large v can be measured.

See table 1, in which γ_m has been calculated as $\gamma_m = 1/\sqrt{(1-v^2/c^2)}$, given the chosen values of v/c, instead of taking arbitrary values.

v/c	$\gamma_m(v/c)$	real v/c
0	1	1,4
0,900	2	2,1
0,950	3	2,5
0,990	7	3,8
0,995	10	4,5
0,999	22	6,7

Table 1

The results show that the one error in STR is used to prove the apparent validity of another error in this theory.

Conclusions

Given the postulate: all physical laws are the same in any inertial system, clocks must run synchronously, independent of their velocity, so time dilation does not exist.

Based on the same postulate: the mass of an object can not be influenced by its velocity.

> *The postulate justifies the statement that each physical experiment carried out in any inertial system shows the same result. The following mind experiment proves the mentioned conclusion. Suppose two masses at mutual distance r in an inertial system. Measuring the mutual gravitational force Gm_1m_2/r^2, will result in the same outcome, independent of the velocity of the inertial system.*

Based on the same postulate: the velocity of light in vacuum can only be ***c*** relative to its source.

As a result:
The STR is invalid, so any restriction on velocities of particles is impermissible.

and thus:
Muons entering the atmosphere most likely do have velocities (much) higher than ***c***.

References

[1] http://physics.gmu.edu/~rubinp/courses/122/readings/AJP000342.pdf

[2] http://vixra.org/pdf/1611.0111v1.pdf The Principle of Absolute Relativity

[3] http://vixra.org/pdf/1502.0151v2.pdf $E=mc^2$: a Self-Evident Non-Physical Equation