The Time of the Photon

Sjaak Uitterdijk

sjaakenlutske@hetnet.nl

*Abstract- A lot has been philosophized and written about the phenomenon 'time dilation'. This article shows the consequences applying this phenomenon to a photon, traveling with velocity **c**, relative to whichever observer, as the Special Theory of Relativity prescribes.*

Historical background

A definition of time dilation is found in for example [1]:
"According to the theory of relativity, time dilation is a difference in the elapsed time measured by two observers, either due to a velocity difference relative to each other, or by being differently situated relative to a gravitational field."

The influence of gravitational forces has not been considered in this article.
"As a result of the nature of spacetime, a clock that is moving relative to an observer will be measured to tick slower than a clock that is at rest in the observer's own frame of reference."

Spacetime is, in [2], defined as:
"In physics, spacetime is any mathematical model that fuses the three dimensions of space and the one dimension of time into a single four dimensional continuum. Spacetime diagrams are useful in visualizing and understanding relativistic effects such as how different observers perceive where and when events occur."

Combining the two citations leads to the conclusion that a **mathematical** model is supposed to have a 'nature', which is not the same as 'property', and that this 'nature' is supposed to be responsible for the phenomenon 'time dilation'.

'Time dilation' is originally defined by Einstein as:
A system S moves with constant velocity v relative to system S'. If time t is related to S "(this "t" always denotes a time of the stationary system)" and time t' to S' then t', as function of t and v, is:

$$t' = \beta (t - vx/V^2) \quad \text{with} \quad \beta = 1/\sqrt{(1-v^2/V^2)} \quad \text{and V now-a-days written as } \boldsymbol{c}$$

Einstein's conclusion therefor was: a clock mounted in S, showing time t, will show in S' time t'.

Pretty soon the variable x, by the scientist under consideration defined as a constant in S, has been neglected in the time-transformation formula. Most likely because it made the expression immediately extremely suspicious regarding its credibility.

So what is left now-a-days is: $t' = \gamma t = t/\sqrt{(1-v^2/c^2)}$

Might it be that β has been changed into γ in order to obtain a less suspicious change, after having eliminated the variable x without any explanation?

Influence of the Principle of Relativity

The Principle of Relativity has been postulated by Einstein but is a rather restricted version of the postulate that all physical laws are the same in any inertial system.
Therefor the words "Principle of Relativity" will not be used hereafter anymore.

Another problem showed up: the postulate that states that all physical laws are the same in any inertial system, hereafter shortly written as *the postulate,* leading to the conclusion that the same physical experiment, carried out in any inertial system, will show the same result.

Reading a clock is fundamentally carrying out a physical experiment, because a clock is an instrument developed and produced in order to measure the variable 'time'.

So mounting a clock, based on the same physical laws, in as well S as S' must lead to the conclusion that they will both show the same time.

Normally such a conclusion should mean: exit Special Theory of Relativity.

Given this contradiction with *the postulate* the approach of the supposed phenomenon 'time dilation' has been changed, based on the following consideration.

Clocks indeed do not measure different times in any inertial system, but observers of clocks will observe different 'times' when moving with constant v relative to clocks!
To repeat a citation above:
"As a result of the nature of spacetime, a clock that is moving relative to an observer will be measured to tick slower than a clock at rest in the observer's frame of reference."

Mind the expression: "a clock ...... will be measured to tick slower ..." !

In sound physical science such a measurement would be qualified as seemingly carried out wrongly, because *the postulate* prescribes that the clock doesn't change the speed of its ticks, whatever observer observes it.

Einstein made a second fundamental mistake by stating that a clock mounted in S and showing time t will show time t' in S'.
He forgot, the author assumes, to consider that the speed between S and S' is mutual, meaning that not only S' moves with |v| relative to S, but also vice versa.

In the expression $t' = t/\sqrt{(1-v^2/c^2)}$ it doesn't matter whether v is positive or negative!
As a result is doesn't matter either to what system t and t' are assigned.

The expression can also be written as $t = t' * \sqrt{(1-v^2/c^2)}$ leading to t = 0 for v = ***c***.
This is an interesting phenomenon from the point of view of a photon, propagating in vacuum with v = ***c*** with respect to whichever observer, as the STR prescribes.

As has been argued it is free to define to what system t resp. t' belongs. So suppose t' belongs to the observer and t to the photon. Then the observer observes that the clock in the photon does not run (t is zero). What has to be concluded now?

-that the observer did not observe correctly?

-or that time belonging to the photon does not change/exist?

Those who believe in the correctness of the STR will reject the first possibility. Reference [3] shows that the concept of time belonging to, for example, a muon is generally accepted.
So time belonging to a photon must also be an unavoidable concept in STR.

Taking the second possibility gives rise to the question whether the (observed) EM-frequency of the photon might change as drastically as time does.
'Frequency' is defined as the reciprocal value of 'period time'. The period time has become as zero as the time of the photon does. So the frequency of the (observed) EM-field in the photon has become infinite, leading to a situation that the photon is outside the visible spectrum/not visible anymore.
Or do we have to conclude that the width of the pulse is zero, in which case the photon is neither visible. See [4] for a detailed model of the photon.
It is up to the STR-defender to solve this dilemma.

Let us change the allocations of the two times, so suppose t belongs to the observer and t' to the photon and $t' = t/\sqrt{(1-v^2/c^2)}$.
Now the time t' in the photon is infinite, resulting in an EM-frequency of zero.
Again the photon is not visible and again the STR-defender has to solve this dilemma.

Conclusion

A photon does have a velocity ***c*** relative to whichever observer, as the Special Theory of Relativity prescribes.
As a result the time dilation formula eventually prescribes that a photon will not be visible for whichever observer. So no observer will observe light.
It is up to the STR-defender to decide what to do with this deadly contradiction with reality.

References

[1] https://en.wikipedia.org/wiki/Time_dilation

[2] https://en.wikipedia.org/wiki/Spacetime

[3] http://vixra.org/pdf/1708.0087v1.pdf
Velocity of Cosmic Muons Most Likely Much Higher Than ***c***

[4] http://vixra.org/pdf/1505.0225v5.pdf Why a Photon is not a Particle