The umpteenth evidence

Sjaak Uitterdijk
sjaakenlutske@hetnet.nl

Abstract-In this article section 1 and 2 of Einstein's article about his Special Theory of Relativity have been scrutinized. The conclusion is that Einstein spent a lot of text on the concepts simultaneousness, synchronousness and time, without bringing forth any relevant information. Besides that he made two fundamental mistakes.

Introduction

Suppose there are two marks, A and B, in an infinite space of vacuum at a constant distance AB. Imagine a light ray, coming from a source at an arbitrary distance from A, passing A and B at the times t_A respectively t_B.
The speed of ***this light***, so in vacuum, on the trajectory AB is, by definition, $AB/(t_B-t_A)$.
The reason for printing "***this light***" is that the velocity of light in vacuum is determined by its source! So each source in for example the universe does have its own velocity in universe.
Fully opposite to Einstein's idea about this phenomenon!
So let us have a look at Einstein's perception of such a situation.

Einstein's thought experiments in section 1

He wrote in his article in 1905, copied from [1], from now on printed as italicized text:

> *We have so far defined only an "A time" and a "B time." We have not defined a common "time" for A and B, for the latter cannot be defined at all unless we establish by definition that the "time" required by light to travel from A to B equals the "time" it requires to travel from B to A. Let a ray of light start at the "A time" t_A from A towards B, let it at the "B time" t_B be reflected at B in the direction of A, and arrive again at A at the "A time" t'_A.*
> *In accordance with definition the two clocks synchronize if $t_B - t_A = t'_A - t_B$.*

This philosophy shows that E fully rejects the possibility of a so-called common time for A and B, unless lights travels the distance AB forth and back during the same time.
N.B. The light source is located in A, so his criterion in the last sentence is most trivial.

After a short consideration about 3 synchronously running clocks E continues with:

> *Thus with the help of certain imaginary physical experiments we have settled what is to be understood by synchronous stationary clocks located at different places, and have evidently obtained a definition of "simultaneous," or "synchronous," and of "time.*

E seemingly considers simultaneous equivalent to synchronous, notwithstanding the fact that simultaneously simply means: at the same moment, while synchronously means: running with the same frequency/rate.

> *The "time" of an event is that which is given simultaneously with the event by a stationary clock located at the place of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified stationary clock.*
> *In agreement with experience we further assume the quantity*
> $$2AB/(t'_A - t_A) = c,$$
> *to be a universal constant—the velocity of light in empty space.*

Here E makes his first fundamental mistake: he defines c as the velocity of light in empty space resulting in an undefined velocity.
The background for this mistake is that he located the source in A (*Let a ray of light start ..... from A....),* but failed to mention this explicitly in his statement.

Einstein declares:

> *It is essential to have time defined by means of stationary clocks in the stationary system, and the time now defined being appropriate to the stationary system we call it "the time of the stationary system".*

One might wonder what might be essential in this declaration.

His definition of "stationary" system is presented and commented in the appendix.

So at the end of section 1 Einstein hasn't brought up any new concept: simultaneously and synchronously were already well known and have not been changed. He declares clocks running synchronously by means of a most trivial criterion, and time is still time!

Einstein's thought experiments in section 2

Einstein starts with the postulate:

> *Any ray of light moves in the "stationary" system of co-ordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body.*

Given the fact that he only considers a stationary light source in section 1, he now postulates, without any argumentation, that it doesn't matter whether this source is moving or not relative to the "stationary" system.

> *Hence velocity = light path/time interval, where time interval is to be taken in the sense of the definition in § 1.*

That means: measured by synchronously running clocks, located at the beginning and at the end of the related light path.

Einstein now introduces a moving rod, with a constant velocity v relative to the "stationary" system, defining the ends by means of A respectively B.
He considers two methods to measure the length *l* of this rod:

-method "a" directly by means of a measuring rod in the moving system of the rod,
-method "b" by means of clocks and with help of a light ray in the "stationary" system.

> *The length to be discovered by the operation (b) we will call "the length of the (moving) rod in the stationary system." This we shall determine on the basis of our two principles, and we shall find that it differs from l.*

With this statement he made the second fundamental mistake: if the length of the rod is *l*, as measured by method "a", and method "b" results in a value that differs from *l*, than the only correct conclusion is that method "b" has been carried out incorrectly.
The principle that all physical laws are the same in any inertial system forbids that the length of the rod changes in such situations. Effectively Galilei told us already 400 years ago too.

Einstein's following statement shows another inconsistency in his considerations.

> *Let a ray of light depart from A at the time t_A, let it be reflected at B at the time t_B, and reach A again at the time t'_A. Taking into consideration the principle of the constancy of the velocity of light we find that*
>
> $$t_B - t_A = r_{AB}/c - v \qquad \text{and} \qquad t'_A - t_B = r_{AB}/c + v$$
>
> *where r_{AB} denotes the length of the moving rod—measured in the stationary system.*

The inconsistency concerns the fact that he applies the Newtonian law of addition of velocities, while the end result of his theory forbids such an addition.
Besides that Einstein accepts velocities larger than c in one of the expressions above, while the outcome of his theory also forbids such velocities.

Back to the thought experiment in the Introduction

The situation sketched in the Introduction sounds:
Suppose there are two marks, A and B, in an infinite space of vacuum at a constant distance AB.
Imagine a light ray, coming from a source at an arbitrary distance from A, passing A and B at the times t_A respectively t_B.
The speed of ***this light***, so in vacuum, on the trajectory AB is, by definition, $AB/(t_B-t_A)$.

As Einstein wrote: $t_B - t_A = r_{AB}/(c - v)$

With $r_{AB} = AB$ resulting in: $c - v = AB/(t_B - t_A)$.

So the velocity of light in vacuum, emitted by a source having a relative speed v with respect to the marks A and B, equals c – v on the trajectory AB. *Effectively Einstein's own words!*

Conclusion

Einstein introduced an undefined speed of light in empty space, by failing to define an unambiguous reference for this speed in such a space.

Einstein mixes up the real physical world and the measurement of it by insinuating that if the real length 'l' of a rod is measured by an observer moving with constant velocity relative to the rod, this measurement will differ from that real length ("*...we shall find that it differs from l.").* This is in contradiction to the principle that each physical law is the same in any inertial system.

Einstein accepts velocities larger than ***c*** at the basis of the creation of his theory, by applying the Newtonian law of addition of velocities, so by applying the ballistic theory of light in vacuum. This is in contradiction to the result of his theory.

Light rays in the universe reach the earth with velocity ***c*** + v relative to earth, with v the velocity of the source *at the moment of emission* relative to the velocity of the earth *at the moment of reception*, both projected on the direction of the light ray.

Reference

[1] Translated original article of Einstein:
On the electrodynamics of moving bodies, By A. Einstein, June 30, 1905
To be found at: http://www.fourmilab.ch/etexts/einstein/specrel/www/

Appendix

Einstein wrote his definition of a stationary system right at the beginning of section 1:

> *Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good (to the first approximation).*

This vaguely defined system looks like what nowadays is called an inertial system. However Newtonian mechanics also include motions as a result of forces.
But Einstein's theory explicitly excludes such motions! So this description doesn't make sense.

> *In order to render our presentation more precise and to distinguish this system of co-ordinates verbally from others which will be introduced hereafter, we call it the "stationary system.*

It turns out that the systems "introduced hereafter" simply move with a constant speed, relative to this "stationary" system. So eventually Einstein only considers inertial systems.
He should simply have brought it as such, for example by means of the words "non-forced systems", if the concept "inertial systems" had not been introduced yet.