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Special Relativity and Newtons Axioms

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Abstract

The specal relativity theory (SRT) was developped by Albert Einstein initially to explain the independence of the spread velocity of light from the relative velocity between the light source and the light receiver. Applied to the course of time in an inertial coordinate system (CS) which moves with nearly the spread velocity of light, in the view of an observer in this CS and another one outside, far away and "resting", time seemed to run in the moving CS for the former just as if he were "resting", for the latter in contrary significantly slower (time dilation). However, this is a faulty view because the results of the SRT were applied only partly.

It is shown in two ways which do not presuppose a space time continuum, and by complete application of the SRT, that no relativity of time is needed, hence time stays absolute.

Some of the best known effects, which were described by the SRT, are now described by means of classic Newton's physics.

1 Introduction

Albert Einstein has developped the SRT initially to create a model which explains the light velocity paradoxon, after what the spread velocity of light is independent from the relative velocity between the light source and the light receiver and what was not understood at that time. In the meantime it was shown that this effect can be described and understood by means of the basic physical rules of the electromagnetic oscillation theory [1]. Therefore, to explain this phenomenon, SRT is unnecessary and much too complex.

The SRT meanwhile describes other effects, too. Following a well known Einstein citation[1], the question is, if some of these effects could be described in a more simple way and especially by the rules of classic physics.

The goal of this paper is, following this citation, to find out how far one can proceed by means of classic physics, hence Newton's axioms, to describe the phenomenons demonstrated by experimental physics and derived from thought experiments, which until now are described by the more complex SRT.

2 Relativity of Space and Time

Looking at a theoretical event like the operation of a light clock [cf. eg. 2] in a CS with a velocity near spread light velocity from the view of an observer in the same CS (moving observer) and one in a distant CS (distant observer), the relativistic view is that the moving observer sees the light clock operate in just the same way as before the acceleration, while the distant observer sees the clock slowing down with increasing velocity of the moving CS towards the spread velocity of light.

This view, however, is not correct with respect to the observation of the distant observer because the changing distance between observer and light clock from the start of a light pulse until its return was not taken into consideration. After all, the informations concerning these two events can be submitted to the distant observer only by light or radio, hence with light velocity, which means that the information concerning the second event arrives delayed with respect to that of the first event (if the CS of the moving and that of the distant observer depart from each other; in communications

[1] "Make things as simple as possible – but not too simple"

technology called "group velocity"). From that the distant observer gets the impression that the operation of the light clock is slower than that of his clock. Knowing the relative velocity between his CS and that of the moving observer, this delay can be taken into account, and the result is that the distant observer sees the operation of the light clock corresponding with that of his clock and with the view of the moving observer.

Supposing – as customary until now – that the distant observer gets the informations about the events in the CS of the moving observer without delay by the transmission, there were no change in the result. The distant observer now sees how the light of te light clock seemingly does a longer way, from which until now was deducted that it travels longer until it returns to the transmitter. However, it was overlooked that seemingly the velocity grows, too, by which the distant observer sees the light moving, because the relative velocity between the CS of the moving and the distant observer has to be (geometrically) added to the real light velocity, just as it was done with the distances. This seeming increase in light velocity exactly compensates the seeming increase in the distance.

Finally, it can be shown by means of the SRT itself that the views of the moving and distant observer on the light clock are identical: The SRT postulates that the distances in the direction of the movement of the light clock are shortened by the factor $\frac{1}{\gamma}$. The distance which the light clock travels while the light travels the distance l is such a distance. If this shortening is taken into account, the light clock operates the same way in the view of the moving and the distant observer.

Thus, the basis of the SRT is refuted. There is no difference between the views of the moving and the distant observer and hence the entitlement for a theory which explains such a difference is inapplicable.

The experimental results and thought experiments, however, which until now were explained by the SRT now must be brought into line with the classical physics. This shall be done for the most important ones in the following chapters.

3 Dependency of Mass on Velocity

The mass increase of an object with finite rest mass when approaching spread light velocity, which was predicted by the SRT and confirmed by numerous experiments, can be demonstrated by the classic Newtonian physics, too, if the insight is taken into account that mass and energy are equivalent, what Albert Einstein realized [3] and what is confirmed many times by highspeed particle physics.

An accelerated mass gains speed and kinetic energy. The latter is equivalent to an additional mass which at further acceleration must be accelerated, too, and requires additional enery for this purpose. The consequence is that the mass becomes speed dependent with a minimum, the rest mass, in its CS at zero relative velocity. Because of the velocity dependent mass Newton's acceleration rule (second Newtonian axiom) is only valid in its impulse form. If the infinitesimal increase of kinetic energy with respect to the infinitesimal increase of acceleration is interpreted as infinitesimal mass increase which must be additionally accelerated at the next acceleration step, the integration of the differential equation describing this event up to the spread light velocity yields the mass increase factor γ and the Einsteinian equivalence of mass and energy solely from the classic Newtonian physics (cf. Appendix, Chapter 10.1).

Of course, the increase of mass is not real, but the increase is due to the equivalence principle and, in reality, is an energy increase. The most important result is that energy is inert.

4 Length Contraction

An object which moves away from a distant observer nearly with the spread velocity of light experiences a shortening by the factor $\frac{1}{\gamma}$ in the direction of its movement according to the SRT ([4]).

While approaching spread light velocity it approaches zero length, its mass approaches infinity. This would mean a black hole, which was not observed even at the biggest particle accelerators, but was considered to be possible. The reason is again that the distant observer does not take into account the seeming light velocity (cf. Chapter 3).

5 Myons

Myons are created in the atmosphere at a height of about 6 miles by collisions of air molecules and high intensity cosmic radiation and their velocity at the moment of their creation is very close to spread light velocity. Their medium lifetime at rest is approx. 2.2 microseconds (measuring procedure cf. e.g. [5]).

According to this lifetime, which corresponds to a flight distance of approx. 660 m until disintegration, no myons should be found at the earth surface, but they are. To reach the earth surface without any decay of their velocity, a lifetime of approx. 33 microseconds would be necessary, and because the myons are decelerated by scattering at the air molecules on their way, even remarkably more.

It is now argued that as the myons at creation time are moving with nearly spread light velocity, their liftime, according to the SRT, be by a factor γ bigger than their lifetime at rest, so according to a determination at relativistic myons in a particle accelerator such of 64 microseconds [6]. This bigger lifetime would enable the myons to reach the earth surface. Calculating back according to the SRT to the lifetime at rest also yields approx. 2 microseconds, which is judged to be a brilliant confirmation of the SRT.

Undoubtedly, myons possess a lifetime depending on their velocity, but this is an indirect dependency which has nothing to do with a velocity dependent time dilation.

The disintegration row e.g. of a negative myon is the same whether it disintegrates close to spread light velocity or at rest: one electron, one photon, one myon and one anti electron neutrino. These particles, however, have much less mass at rest compared with the mass at velocities close to spread light velocity. If the loss of mass at disintegration in both cases were identical, the rest mass of the myon could not cover the loss of mass at all, i.e. the myon would have to be totally transfered into γ radiation.

So, the loss of mass and accordingly the bond energy at "high" velocities is remarkably higher than at rest, and as the disintegration probability descends when the bond energy raises, life time increases. Supposed that the mean lifetime of a myon is proportional to its mass (this is a hypothesis, but a probable one), on the one hand at rest, on the other hand at the velocity of its creation, the factor of the mass and the lifetime increase are identical, namely the Lorentz factor γ. Thus, the result for the velocity dependent lifetime of the myons is the same as assuming time dilation corresponding to the SRT, which, however, does not exist according to Chapter 2.

6 Atomic Clock in Aircraft

The experiment comparing an atomic clock on board a flying aircraft with an identical one at ground showing a small time delay of the clock on board the aircraft seems to prove time dilation depending on speed. This experiment from 1971 carried out by Hafele and Keating [7] contains such serious shortcomings, which at least partially were admitted later on by the authors, too, that it can not be taken serious. Additionally it has to be considered that the presumption, the clocks be in unaccelerated CS, is not valid for either of them, and that the elevation of the clock on board the aircraft from ground to flying height in the gravitational field of the earth supplies (potential) energy to the clock, such rising its mass, where the supplied potential energy at a flight speed of 250 m/s at an altitude of 10 km is approx. 1.5 times larger than the kinetic one and therefore plays the more relevant role.

There are reported time dilations of approx. 250 nanoseconds at flight times of 65 hours and more, which would yield a time dilation (time difference of the clock on ground, 30 km/s on its orbit around the sun, compared with that on board the aircraft, 30.25 km/s) by SRT of approx. 0.09 ns/s, hence a

time dilation per hour flight time of 324 ns compared with the clock on ground. This is a time difference reached in the experiment not within one, but within 65 hours of flight time. As the orbit velocity of the sun around the centre of the milky way is even much larger (250 km/s), the correct SRT calculation yields a much larger (tenfold) time dilation. But anyway, the application of the SRT is not allowed because of the missing inertial characteristic of the coordinate systems.

7 Twin Paradox

This means the following thought experiment: A twin starts a space flight straight away from the earth with a velocity near spread light velocity, after a flight duration of e.g. five years according to his clock turns over, and returns on the earth after ten years. He has become ten years older according to his clock, but he discovers with great astonishment that his brother on the earth now is remarkably older than he. According to the SRT, time runs slower in CS whose velocity is not small compared with spread light velocity as in CS at rest, and therefore he has aged slower than his brother.

With the help of an (x,t) diagram it can be easily assessed whether this statement is correct (Figure 1).

The t coordinate is dimensioned in a way by multiplying it with the spread light velocity that the result is the same way per unit of time as on the x coordinate when one moves in this direction with spread light velocity. An object which is locally at rest, hence moves on or parallelly to the t coordinate, one which moves locally, in the direction of the t coordinate as well as in the direction of th x coordinate, and could it move with spread light velocity, on a $\pm 45°$ straight line.

Watching the twins, this situation is found: A stays on the earth, "moving" on the t coordinate. B moves with a velocity close to the spread light velocity, beginning at t = 0, in the direction of the positive x coordinate straight away from the earth, i.e. he moves on a straight line through coordinate zero which has an angle of less than 45° against the t coordinate. He sends a radio signal to A every second according to his clock. As he is rapidly moving away from A, the runtime of every radio signal following up increases and every signal arrives at A more than a second later compared with the signal before. It seems to A as if the time in B's spacecraft goes by slower than on the earth. One can turn round this and let A send the radio signals. Then for B time at A seeems to run slower. When they meet again, from the view of either of them the other is older.

According to the SRT, the time dilation factor is the Bondi factor k ($k = \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}$, cf. [8]). When the spacecraft is on its way back, it moves on a straight line with an angle of less than –45° against the t coordinate. Now the radio signals arrive at A with a gap of less than one second. According to Paus [8] the reduction factor is $\frac{1}{k}$. Hence, if B has sent n radio signals on each half of the space flight, elapsed time for him on this journey is

$$t = 2nT$$

and for A

$$t' = n(k + \frac{1}{k})T \equiv 2nT\gamma \geq t$$

As can be seen easily, however, the increase of the runtime of the radio signals its not multiplicatively, but additively proportional to the grown distance of the spacecraft between two adjacent radio signals, $\Delta t = \frac{v}{c}T$, and on the way back the same is valid for the shortening of the runtime:

$$t' = n(T + \Delta t) + n(T - \Delta t) \equiv t$$

Hence, the twin "paradoxon" turns out to be a logical fault in the thought experiment. It is surprising that despite the high age of the experiment, this fault was not detected earlier.

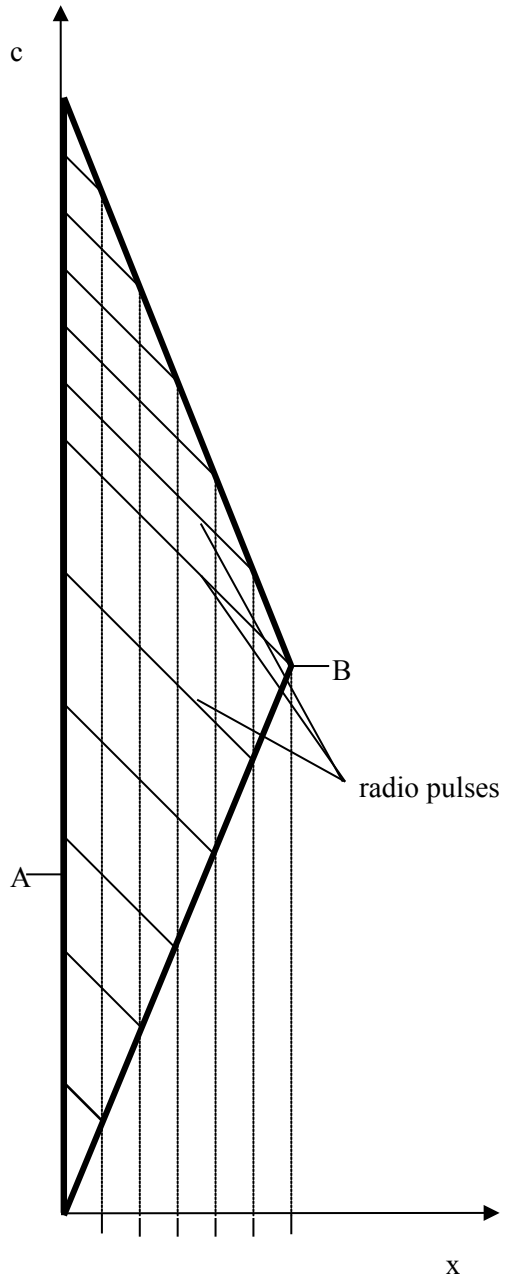

Figure 1: World Lines of Twins

Occasionally it is claimed that the acceleration phases must be taken into account. Apart from the fact that the SRT is not valid in accelerated CS by definition, nothing is altered on the additive character of the change of the runtime of the radio signals and hence on the cancellation of the effect on the outward and backward flights.

8 Essential Conclusions

To describe the penomenons occuring at velocities close to spread light velocity, it is not necessary to presume time to be relative. The second Newtonian axiom, rather, is absolutely sufficient (cf. Appendix, Chapter 10.1) without the necessity of different views of the observer at rest and the moving one and hence time being relative. Additionally, the thought experiment (Chapter 3) which was used to justify the idea of a relative time was interpreted falsely, and therefore this idea is obsolete together with the theory explaining it.

9 Outlook

Returning to time being absolute has remarkable consequences on astronomy and cosmology. Therefore, every model idea must be assessed where the relativity of time or the space-time continuum plays a role, especially in the direction if, without the assumption of relative time or a space-time continuum, all observed phenomenons can be explained satisfyingly and be modelled reasonably by means of the classical physics, i.e. to apply the famous "Ockham's razor". Especially, there is to think of the field theories like e.g. the General Relativity Theory and its best known consequences (e.g. "black holes", gravitation waves).

10 Appendix

10.1 Dependency of Mass on Velocity, demonstrated by Newtons Axioms

From particle accelerator experiments it is known that particles with finite rest mass can not be accelerated up to the spread light velocity, but their mass increases by approching spread light velocity with a pole of mass at spread light velocity. This is corroborated by the SRT which postulates a relationship γ of the velocity dependent mass and the rest mass

$$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \tag{1}$$

Additionally it is known [3], as well from particle accelerator experiments, that mass and energy are equivalent because the one can be transferred into the other:

$$E \sim m = C \cdot m \tag{2}$$

An accelerated object gains velocity and kinetic energy; the latter is, according to (2), equivalent to an additional mass which must be additionally accelerated when further accelerating the object and for this purpose needs additional energy. Therefore, mass becomes velocity dependent with a minimum, the rest mass in the actual CS, at low velocities v_0. With respect to the velocity dependent mass the Newtonian acceleration law now is only valid in its impulse form,

$$K = \frac{dp}{dt} \equiv \frac{d(mv)}{dt} \tag{3}$$

The infinitesimal increase of kinetic energy with respect to an infinitesimal increase of velocity is, according to (3)

$$K = \frac{d(mv)}{ds}\frac{ds}{dt} \tag{3a}$$

$$Kds \equiv dE_{kin} = vd(mv) \tag{3b}$$

$$dE_{kin} = v^2 dm(v) + \frac{1}{2} m(v) d(v^2) \tag{4}$$

This increase of energy is equivalent to an infinitesimal increase of mass which has to be accelerated additionally at the next (infinitesimal) acceleration step (cf. (2)):

$$dE_{kin} = Cdm(v) \tag{5}$$

(4) and (5) yield

$$Cdm(v) = v^2 dm(v) + \frac{1}{2} m(v) d(v^2) \tag{6}$$

$$(C - v^2) dm(v) = \frac{1}{2} m(v) d(v^2) \tag{6a}$$

$$\frac{dm(v)}{m(v)} = \frac{1}{2}\frac{d(v^2)}{C - v^2} \equiv -\frac{1}{2}\frac{d(1-\frac{v^2}{C})}{1-\frac{v^2}{C}} \tag{7}$$

If (7) is integrated from v_0 to v, a short intermediate calculation yields

$$\frac{m(v)}{m(v_0)} = \frac{\sqrt{1-\frac{v_0^2}{C}}}{\sqrt{1-\frac{v^2}{C}}} \tag{8}$$

Particles with finite rest mass can not be accelerated up to spread light velocity as is known from particle accelerator experiments. Their mass grows over all borders when approaching spread light velocity, i.e. the mass has a pole at v=c. From this follows:

$1-\frac{v^2}{C} = 0$ for v=c, hence $C = c^2$

This yields

$$\frac{m(v)}{m(v_0)} = \frac{\sqrt{1-\frac{v_0^2}{c^2}}}{\sqrt{1-\frac{v^2}{c^2}}};\ v_0 << c: \qquad \frac{m(v)}{m(v_0 \approx 0)} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \tag{9}$$

and with (2)

$$E = mc^2 \tag{10}$$

This is exactly the relationship for m which the SRT yields by the application of the Lorentz transformation, too, but without the necessity of an assumption of different views of the moving and the distant observer and hence to the realtivity of time, and for the equivalence of energy and mass from Einstein's photo emission experiment [3]. Here, both relationships for m(v) and C were derived from the classical Newtonian mechanics.

11 References

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