Special Relativity, Lorentz Transformation and the Relativity of Simultaneity

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Abstract
In this paper we shall study the constancy of the speed of light in special relativity basis on Lorentz transformation and the relativity of simultaneity.

Suppose a train started to move from pylon A at constant velocity v for both the two observers, the observer on the ground at pylon A with coordinates systems (x,y,z,t) and the observer on the moving train with coordinates systems (x’,y’,z’,t’) as in fig. (1).

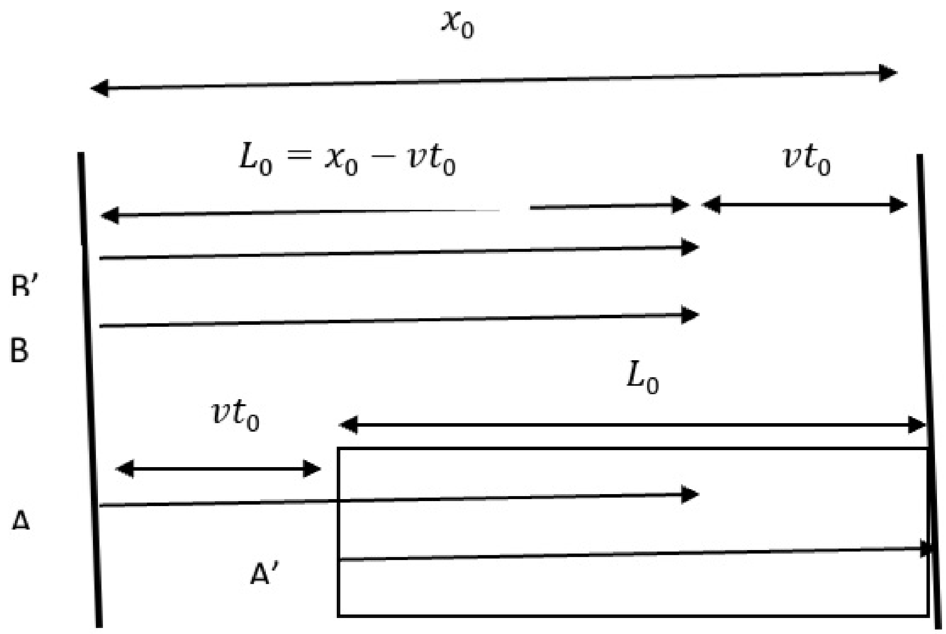

Figure (1): The light paths of the two light beams on the ground and inside the moving train for the both the two observers on the ground and on the moving tran.

Now suppose at x=x’=0, t=t’=0 two light beams were sent, one from pylon A and the other beam were sent from the back of the moving train. At the moment that the light beam that was sent from the back of the moving and arrived the front of the moving train for the observer on the moving train as in A', at this moment, the back of the train passed the distance vt_0 from pylon A where

$$t' = t_0 = \frac{L_0}{c} \qquad (1)$$

And the clock of the train observer registered the proper time according to his clock where $t' = t_0$ as in eq. (1) where the proper distance in this case is $L = L_0$ the real length of the moving train for the train observer.
And according to this according to the observer on the moving train when the light beam A' arrived the front of the moving train, the front of the moving train arrived pylon B. In this case the distance between the front of the moving train at pylon B and pylon A is the distance between the two pylons on the ground which is

$$x_0 = L_0 + vt_0 \qquad (2)$$

The distance $x_0 = L_0 + vt_0$ which is the distance between the two pylons is the proper distance for the ground observer

Now for the observer on the ground at pylon A the light beam which was sent from pylon A is at distance x from pylon A which is defined as

$$x = x_0 - vt_0 = L_0 \quad (3)$$

And at this time the clock of the ground observer registers the time separation t where

$$t = \frac{x}{c} = \frac{L_0}{c} = t_0$$

According to that we find at this moment the clock of the ground and the clock of the moving train register the same time separation of the event where

$$t = t' = t_0 \qquad (4)$$

If we multiply equation (3) by the Lorentz factor gamma we get

$$x'' = \gamma(x_0 - vt_0) = \gamma L_0 = x_0 \quad (5)$$

And the same thing we can write

$$t'' = \gamma\left(t'_0 - \frac{vL_0}{c^2}\right) = \gamma t_0 = \frac{x_0}{c} \qquad (6)$$

Now eq.(5) represents the proper distance between the two pylons for the observer on the ground which is $x'' = x_0 = \gamma L_0$ and t'' the proper time that registered by the clock of the observer on the ground for the light beam to pass the distance between the two pylons and this time equals to γt_0 and from equation (6) we find

$$t'_0 = \frac{x_0}{c}$$

While

$$t_0 = \frac{L_0}{c}$$

We find at the moment that the light beam which was sent from the back of the moving train arrives the front of the moving train and the front arrives pylon B for the observer of the moving train as in A', the observer on the moving train registered time separation for the event

$$t' = \frac{L_0}{c} = t_0$$

At this time for the ground observer, the light beam which was sent from the back of moving was not reaching the front of moving train as in A, but it is at a distance from pylon

A equals to $x = x_0 - vt_0 = L_0$ as in equation (3). And the time registered according to the clock of the observer on the ground is

$$t = \frac{x}{c} = \frac{L_0}{c} = t_0$$

And according to that at this moment we find

$$t = t' = t_0$$

Where there is no time dilation or difference in time as proposed by SRT or length contraction. We find also the light beam which was sent from pylon A for observer on ground as in B is moving at the same time with the light beam which was sent from the back as in A for the ground observer. We can write also for the ground observer, the distance of the two light beams A&B from pylon A is defined as

$$L_0 = \gamma^{-1} L_0 + vt_0 \quad (7)$$

We find the length contraction $\gamma^{-1} L_0$ in (7) is not real but it represents the delay of the two light beams A&B for ground in space comparing to A' for the train observer as in fig. (1). Now when light beam as in A' arrives the front for the train observer and the front arrives pylon B at a distance $x_0 = L_0 + vt_0$ from pylon A, at this moment the light beam will leave the vacuum of the moving train to the vacuum of the ground and will appear at pylon B for the observer on the ground when it leaves the vacuum of the moving train. For the observer on the ground the light beam inside the moving train is transformed from a distance $L_0 = \gamma^{-1} L_0 + vt_0$ from pylon A to $x_0 = L_0 + vt_0$ at pylon B in a zero time separation. It is like the light beam is existed in two places at the same time when it leaves the vacuum of the moving train to the vacuum of the ground as the result of the difference in space. This distance $x_0 = L_0 + vt_0$ was passed by the light beam inside the moving train in a time separation according to the clock of the ground observer

$$t = \frac{x}{c} = \frac{L_0}{c} = t_0$$

Not in a time separation as in eq. (6)

$$t'' = \gamma t_0 = \frac{x_0}{c}$$

And from eq. (5) we find $x_0 = \gamma L_0$ where γL_0 does not mean that the length of the moving train would be increased as most relativists think, but γL_0 represents the proper distance between the two pylons on the ground as defined in eq. (2). We find also γt_0 does not represent what the clock of the ground observer registers now when the light beam inside the moving train arrives pylon B for the ground observer. Since according to the clock of the ground observer the light beam inside moving train arrives pylon B and passed the distance between the two pylon x_0 in a time

$$t = \frac{x}{c} = \frac{L_0}{c} = t_0$$

which is less than

$$t'' = \gamma t_0 = \frac{x_0}{c}$$

This difference in time will appear in doppler effect as the light beam inside moving train would be increased. The required time separation for the light beam B as in fig. (1) which was sent from pylon A according to clock of the ground observer is $t'' = \frac{x_0}{c}$ in

order to reach pylon B where it is still delayed comparing to light beam A which arrived pylon B in a time separation $t = \frac{L_0}{c}$.
Now if we consider the light beam B' for the train observer which was sent from pylon A, we find it is delayed in space comparing to A' and the distance from pylon A is

$$L_0 = \gamma^{-1} x_0$$

This is length contraction defined in SRT that the distance between the two pylon is contracted relative to the train observer. But the length contraction of the distance between the two pylons would be equal to L_0 and according to this length contraction which equals to L_0, the light beam which was sent from pylon A must reach pylon B at the same time with the light beam A' inside the moving which arrives the front of the moving train and the front arrives pylon B, and in this case if the length contraction is real, in this case there must be no doppler effect and this not true experimentally.
The same thing if the length contraction of the moving train is real as in eq. (7) for the ground observer, in this case there must be no doppler effect and this is against the experimental results.

Conclusion:

We find in this paper that the length contraction and time dilation are not real and the difference in space and time in SRT must be appeared in the doppler effect. If the length contraction is real, in this case there must be no doppler effect and this is in contradiction with the experimental result. Also refusing the length contraction in order to accommodate the doppler effect will lead to refuse the spacetime continuum in SRT.

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