

Why simultaneity must be absolute - inconsistency in the theory of Special Relativity

Bhagat Singh Rajawat
20th November, 2025

Abstract

With due respect to the wonderful, unmatched intellect of the great physicist Einstein, an attempt is made here in the form of a thought experiment to prove that the theory of special relativity is logically inconsistent. It is also attempted to locate precisely what was wrong in his 1905 paper. The entire theory is pivoted on Einstein's conclusion that simultaneity is relative, not absolute. From this notion only he derives the Lorentz transformation equations, from which emerge the ideas of time dilation and length contraction - which automatically stand invalid if the absoluteness of simultaneity is proved.

How Einstein established that simultaneity is relative

In his famous paper of 1905 on special theory of relativity, the great physicist Einstein established that the simultaneity is relative, and not absolute - that means, to say that two events at two different places happened at the same time - need not be universally true, they just appear simultaneous to some observer, and some other observers may find that they happened at different times.

To arrive at this conclusion, Einstein starts (in the 1905 paper) with the notion that absolute rest is meaningless, as there is no way to claim for anything to be in absolute rest or in uniform motion without reference to something else, or in other words, to determine if an object isolated in space is at rest or moving uniformly. Therefore, any inertial frame of reference may rightfully think of itself as “stationary”.

Einstein uses one such “stationary” frame of reference having two clocks at points A and B and defines “time” for this frame as follows. To define a common time of this frame, we must establish by definition that the time taken by a light pulse to travel from A to B is equal to the time taken by the light pulse to travel from B back to A. Note that, we must “define” (or, “assume”) this for our “stationary” system, as otherwise there is no way for us to know if it is really stationary in space or not (if it is moving in space, the two times of the travels of light pulses between the clocks shall not be equal, but there is no way to determine such a motion, so we are free to assume so). Now, the clocks are synchronised if, for a light pulse starting from A at time t_A (showing in the clock at A) reaching point B at time t_B (showing in the clock at B), reflecting at B and starting back towards A, and reaching there at t_A' (showing in the clock at A), only if

$$t_B - t_A = t_A' - t_B$$

Then, it is explained that two clocks which are moving in this “stationary” frame of reference, with two observers also moving with them, although synchronised with the clocks of the “stationary” system, will no longer be found synchronised with each other, when those observers apply the same criteria of light pulse travelling between the clocks in two directions.

This reasoning leads to the conclusion that simultaneity of two events is a mere relative observation dependent upon the frame of reference, not an absolute truth.

This consideration is the foundation of this theory which further leads to the development of Lorentz transformation equations length contraction and time dilation between frames of reference travelling relative to each other.

Showing the inconsistency of the theory

To prove that the Special Theory of Relativity is not logically inconsistent, the following reasoning is presented. If the theory is correct, all inertial observers can predict correctly what is going to be the outcome of an experiment, and if the outcome,

as seen by any of them, is not what he or she expected, then the theory cannot be correct. We use the following thought experiment to test the Special Theory of Relativity.

Suppose a train with glass walls (such that it's possible to see from outside what happens inside the train, but not the other way around) is running at a uniform velocity. There are two observers - one in a carriage of the train, and the other standing on the ground. There is a source of light in the middle of the carriage, which emits two light rays - one towards the left wall of the carriage and the other towards the right wall. On the walls, we have installed two identical machines, which are triggered to action when a light ray falls on their sensors. Two springs of equal length are attached to the two machines and the other ends of the springs are connected to a marker, so that the marker points to the middle of the carriage. What these machines do, when triggered, is to pull the springs attached to them. The setup is shown in the Figure 1 given below:

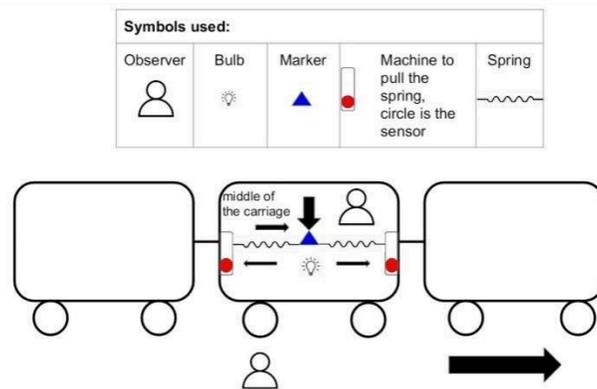


Fig. 1 The setup of the thought experiment.

The two observers use the Special Theory of Relativity, which says that the speed of light is same for all inertial observers, to reason out what is going to happen when the light source emits two light rays (at the same time).

The observer in the train will think that since everything in the experiment is at rest relative to her, and the two light rays travel equal distances with equal speeds to reach the sensors of the two machines, the machines will start working at the same time. And since the machines are identical, they exert equal and opposite forces on the marker at any given point of time. So the marker should remain unmoved.

Whereas, the observer on the ground will think that, although both the rays travel with equal speeds, the left wall is running towards the light ray coming towards it and the right wall is running away from the light ray chasing it. So, the left machine will be triggered before the right machine, and hence the marker must move towards the left.

But we know that the marker will do only one thing - either it will remain unmoved or it will move to the left, certainly not both, as nature does not present different outcomes for different observers in any given context. Outcomes of the phenomena of nature are not affected by what their observers are doing. Or we can say, the laws of nature have nothing to do with observers. *Simultaneity may be relative, as the special theory of relativity tells us, but reality can never be relative.*

Whatever may happen to the marker, one of the two observers will get the unexpected result. So the theory of special relativity (which mandates the same speed of light for all inertial observers), on which the two observers based their reasoning, is incorrect.

This proves that the theory of special relativity and the Lorentz transformations are incorrect.

What is incorrect in the reasoning presented in the 1905 paper and why simultaneity is absolute

Let us look closely at the whole situation, as discussed in the 1905 paper, once again - a “stationary” frame of reference with its clocks at rest at points A and B synchronised using the criteria of light pulses travelling between them, under the “definition” (or, assumption) that the time taken by light to move from A to B is the same as for moving from B to A.

Then we consider two more clocks (again referred to as being at points A and B in the 1905 paper, placed on the two ends of a rod moving with speed v relative to this “stationary” frame) and reason that for a light pulse starting at A at time t_A , reaching B (and reflecting back towards A) at time t_B , and reaching A at t_A' ,

$$t_B - t_A = AB / c - v, \text{ and } t_A' - t_B = AB / c + v$$

and hence conclude that since these two time intervals are not equal, these clocks are no longer in synchronisation.

The flaw in this reasoning will become clear with the following consideration.

The situation here is similar to the following - two trains of equal length standing at rest side by side on a station, with only four passengers in total - two in each, sitting at the ends of the trains, and all their four clocks synchronised, using the light pulse criteria as discussed in the paper. While the train is standing, passengers go to sleep. While they are sleeping, one of the trains is set moving with a uniform speed. When they wake up, will the passengers in the moving train be able to find out that the train is running without looking outside, ignoring jerks and sounds ?

The answer is obviously no, because the principle of relativity tells us that absolute uniform motion cannot be determined. That means, if they perform the light pulse test upon their clocks they must find them synchronised, because if they don't, absolute uniform motion will be revealed, violating the principle of relativity! The moving clocks must pass all possible synchronization tests to conceal the absolute uniform motion. (By the way, this is not the only synchronization criteria. Another possible one is this - if the two clocks at points A and B are synchronous, two observers starting at 12:00 pm in their respective clocks, walking with equal speed towards each other, must meet at the midpoint of AB only. If they meet somewhere else, clocks are not synchronized.)

But according to the reasoning given in the 1905 paper, the passengers in the moving train should find their clocks unsynchronised, if they perform the light pulse test. It means the reasoning given in the paper is unacceptable.

So why is the reasoning given in the paper wrong ? Does the fault lie with the light pulse criteria of determining synchronization ? No. The problem emerges from the incompatibility of the two postulates which Einstein said were “only apparently irreconcilable”.

So what about simultaneity ? absolute or relative ?

Going back to the marker-springs paradox, the marker must not move according to the principle of relativity. Because if it moves, it will reveal the absolute motion of the train. And since the marker's movement is an objective reality independent of any observer, it must remain stationary in the ground frame also. *Therefore, simultaneity is absolute - as absolute as the reality itself.*

We can consider another scenario to prove the absoluteness of simultaneity.

Consider two dumbbells (a rod with ends bigger than the middle part), with 'very long' middle shafts. One is moving, and passes nearby the other. The axes of both the dumbbells are parallel. A mechanism moves the other dumbbell in a direction perpendicular to the motion of the moving one, just at the right time so that the adjacent ends of the two dumbbells touch each other. Now since the two dumbbells remain parallel all the time, it is guaranteed that the front ends of the two dumbbells will touch at the same instant when their trailing ends touch each other. It is a truth of nature,

irrespective of who observes this event - a stationary or moving observer. This consideration reveals that simultaneity is a truth of nature, a necessity, in such situations. Any observer whose clocks show different times for the two touch events, must reflect and understand that his clocks are not correctly synchronised.

Looking at the thought experiment mentioned in the book "Relativity - the Special and General theory" by Einstein - lightning strikes at two ends of a long train

Einstein describes a thought experiment in this book, with which he proposes that simultaneity of two events is not absolute, but relative - dependent upon the observer. It goes like this. A very long train is running, and events of lightning strikes occur simultaneously at the two ends of the train, A and B. An observer is sitting at the middle point of A and B with an arrangement of mirrors that enable him to see in both directions at the same time. A man standing on the platform directly faces this train observer the moment the lightning strikes happen at A and B, while the train is running. Being at equal distance from both A and B, lights from the two events will reach the ground observer at the same time. So he will report that the lightning strikes at A and B happened simultaneously. On the other hand, since the train is running in the AB direction, the train observer, although sitting at the middle point of A and B, is running away from the light coming from A and towards the light coming from B. So, the light from the lightning event at B will reach him before the light from the event of lightning strike at A. So he will report that the two events occurred at different times. Hence the conclusion that

simultaneity is relative. Lightning strikes at A and B happen simultaneously according to the ground observer but at different times according to the train observer.

What's wrong with this argument? Again, if indeed the train observer sees the two lightning events happen at different times, it gives us a way to determine absolute motion - while the train is standing, the lightning strikes appear simultaneously, and non-simultaneous when it is moving. Again we see that the two postulates - the principle of relativity, and the absoluteness of the speed of light - are incompatible.

What is the resolution of this contradiction - either the speed of light is affected by the motion of its source or it is infinite, or the principle of relativity has to be dropped! All these possibilities are troublesome - the first goes against the (null) result of the Michelson-Morley experiment, the second goes against all the experiments to discover the speed of light performed over centuries, and the third is backed by experience. We are back to the 19th century conflict of Maxwell's electromagnetism and classical mechanics.

On the experimental proofs that support the theory

We need to develop a logically consistent theory to explain them.

Acknowledgments

I thank Shri Ramamurti Shankar, J.W. Gibbs Professor of Physics, Yale University, USA and Shri Prabhu Ramchandran, Professor at the department of Aerospace Engineering, Indian Institute of Technology Bombay, India for useful discussions on my ideas related to the subject (not implying their agreement). Also, I thank Ms. Anjana Upreti, my colleague in Kendriya Vidyalaya Sangathan, with whom the starting discussions on relativity led to this paper. I also thank Grok 4, for useful discussions, and categorically accepting my arguments that go against one of the most established theories in science.