

About Tests of Special Relativity

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Abstract

Now the Special Relativity Theory (SRT) is the cornerstone of contemporary physics. The proof of SRT is based on three basic experiments. The analysis of them shows that ordinary physics is sufficient for the interpretation of experimental results and there is no need for SRT. Therefore the above-mentioned experiments are not proof of SRT.

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Introduction

In contemporary physics the Special Relativity Theory (SRT) is the generally accepted and experimentally confirmed theory [1] based on three postulates:

1. The laws of physics are invariant in all inertial frames of reference.
2. The speed of light is constant, i.e., not dependent on the velocity of source.
3. The speed of light is an universal speed limit, i.e., nothing can exceed the speed

of light.

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All the rest is the consequences of the application of Lorentz transformations, i.e., length contraction, time dilatation, relativistic mass, etc.

The main tests mentioned as a confirmation of the SRT are:

1. Michelson – Morley experiment showed that the speed of light is not dependent on the orientation of the apparatus, i.e., it confirms that there is no aether in space.

2. Kennedy–Thorndike experiment showed that the speed of light is not dependent on the velocity of the apparatus, either.

3. Ives–Stilwell experiment is interpreted as a direct proof of time dilatation.

An analysis of the basic SRT tests is disclosed below.

Michelson–Morley experiment

The experiment was an attempt to detect the existence of aether thought to be the carrier of light waves in space [2]. It was performed in 1887 by Albert A. Michelson and Edward W. Morley. They compared the speed of light in perpendicular directions. The result was negative, i.e., there was no evidence of aether. Later several attempts were performed to explain the result by length contraction making aether undetectable as predicted by Lorentz transformations.

In reality Michelson–Morley experiment is the negative aether drift experiment. There is no need for the SRT. It confirms that aether is not necessary to propagate EM waves.

Kennedy–Thorndike experiment

The experiment [3] first was conducted in 1932 by Roy J. Kennedy and Edward M. Thorndike. It is similar to Michelson–Morley experiment. The difference is that a beam of homogeneous light is split into two beams which are brought together again

after traversing paths of different lengths. In this case the relative phases will depend on the velocity of the apparatus. The result was negative. The speed of light does not depend on the velocity of the source. It can be explained by the SRT only if there is length contraction together with time dilatation.

In reality the independence of the speed of light from the speed of the source is a fundamental property of electromagnetic (EM) field. From the moment of generation the EM wave is not dependent on the source. The speed of EM wave is dependent only on the properties of space where it propagates, i.e., on permittivity ϵ and susceptibility μ [4]. There is no direct interrelation with the SRT.

Ives–Stilwell experiment

The experiment [5] was first conducted in 1938 by H. E. Ives and G. R. Stilwell. The experiment is based on the measurement of the transverse Doppler effect. The aim was to calculate the additional Doppler shift due to time dilatation. The result was positive and until now has served as the direct measurement and evidence of real time dilatation.

Actually the time dilatation is apparent as the observer sees it [6]. In reality the time is not affected by the velocity of the observer.

Conclusions

The basic experiments confirm only trivial realities of nature, i.e., that the hypothesis of aether is not necessary for the propagation of EM waves, and the speed of light depends only on the properties of media in which light propagates. These facts are necessary to substantiate the SRT, but the SRT is not necessary to explain the facts. For this reason, they cannot serve to prove the SRT. According to the consequences of

Lorentz transformations, i.e., length contraction, time dilatation, relative mass etc., there is misinterpretation of the results. The Lorentz transformations allow to calculate real length, time, mass, etc., from measured apparent values.

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