

Lorentz transformations and special theory of relativity

Sokolov Gennadiy, Sokolov Vitali
sokolovgsrt@gmail.com

The Lorentz transformations and SRT had the same goal – to extend Galileo's principle of relativity to optical and electromagnetic phenomena. Was this task been solved?

Galileo's principle of relativity

Known since the 17th century, Galileo's principle of relativity affirms the equality of all inertial systems: no mechanical experiments carried out **inside** a given inertial frame allow determining at what speed and in what direction this system is moving. Take an attention: Galileo - 250 years before the special relativity - emphasized that this principle applies only to experiments carried out inside the system, but is violated if you observe signals coming from another system (remember his words: "If you go out on deck, you will see with what speed and in what direction your ship is moving"). In classical mechanics, Galileo's principle of relativity still works flawlessly.

Lorentz transformations

At the beginning of the 19th century, after Thomas Young's experiments with a double-slit interferometer, the corpuscular hypothesis of light was rejected, the wave theory was significantly strengthened and the propagation of light was considered as the movement of waves relative to a stationary ether. The wave theory explained all the known optical phenomena, but as soon as the first experiment with the movement of the light receiver was carried out, problems arose.

In 1801, D. Arago, observing through a prism the light of a star, towards which the Earth moves relative to the ether with orbital speed V , tried to detect a change in the angle of refraction of the prism. It turned out that the angle did not depend on the speed of the Earth's motion, and Fresnel explained this by partial dragging: the effect is absent, because the moving glass drags the ether not completely, but partially.

Note: Arago's experiment, in principle, could not detect the movement of the Earth, since it was carried out in an atmosphere moving with the Earth. The light of a star enters the atmosphere at a speed of $C + V$, but due to the re-emission of photons by air atoms, its speed and frequency change, relative to the air, light

travels at a speed of C / n and meets the prism at the same speed, coming from any other source.

In 1851, Fizeau carried out interferometric experiment with the entrainment of light by moving water. It is assumed that this experiment has confirmed Fresnel's hypothesis: moving water entrains light also **not completely, but only partially**. Later, the result of this interferometric experiment was repeatedly confirmed by other researchers and gave the same result. Fizeau's experiment with moving water is considered one of the main confirmations of the special theory of relativity.

Note: In fact, Fizeau's experiment does not confirm, but refutes the hypothesis of partial dragging. In our work [1] it is shown that this interferometric experiment **proves the complete, but not partially, the dragging** of light by the moving water.

The ether hypothesis made it possible to explain all the properties of light known at that time and was supported by most scientists. Maxwell also considered light as vibrations of the ether: "that light itself is not a substance is proved by the phenomenon of interference" [2].

In 1881, Michelson carried out an interferometric experiment, the main purpose of which was to determine the motion of the Earth relative to the ether. The zero result of this experiment allowed Michelson to declare that there was no ether.

A critical situation developed: all interferometric experiments confirmed the wave hypothesis based on the luminiferous ether, and this experiment proved with high accuracy that there was no ether.

To save the hypothesis of the ether, several authors at once (Vogt, Fitzgerald, Larmor) explained the zero result of Michelson's experiment, putting forward a hypothesis about the reduction in the size of the body in the direction of its motion relative to the motionless **ether**. Lorentz later developed coordinate and time transformations known as **Lorentz transformations**. Poincaré, who also formulated the principle of relativity in 1898, gave the Lorentz transformations a more rigorous mathematical formulation.

Lorentz transformations, affirming the equality of all inertial frames, allow you to determine coordinates and time in inertial frames moving relative to the **ether**. Proceeding from the condition that Michelson's device **moves in the ether**, Lorentz and Poincaré explained the absence of displacements of the fringes in the interferometer by the dynamic properties of the **ether**: due to the interaction with the motionless ether, the longitudinal size of the interferometer changes so that the light travels both distances in the same time. The belief in the validity of the wave hypothesis and the existence of the ether was so great that no options for the "non-etheric" explanation of this experiment

were even considered.

Lorentz transformations made it possible to extend the principle of relativity to optical and electromagnetic phenomena in inertial frames moving in the **ether**.

At the end of the 19th century, a photoelectric effect that contradicted the wave hypothesis was already discovered. In 1900, Planck postulated the quantum nature of the emission and absorption of the energy of the electromagnetic field, undermining the foundations of the wave theory of light. And it was already known that the speed of light in any transparent medium is determined by the refractive index of this medium and does not depend on the direction of propagation, which made it possible to consider the experiments of Oersted, Ampere and Faraday as satisfying the principle of relativity.

The principle of relativity, provided that there is no ether.

So that Michelson's experiment did not contradict the principle of relativity, it was enough just to abandon the wave theory and the ether hypothesis, as Planck, Lenard and others did. The zero result of this experiment would confirm with high accuracy only that, relative to the interferometer, light propagates in all directions in the air at the same speed and therefore the stripes do not shift.

The problem of extending the principle of relativity to electromagnetic and optical phenomena arose only because of the hypothesis of the motionless ether penetrating all bodies. Rejection of the ether hypothesis allows a deeper understanding of the "extension" of the principle of relativity and a clearer definition **Galileo's principle of relativity**:

The principle of relativity states the equality of all inertial frames: no mechanical, optical and electromagnetic experiments conducted **inside** an inertial frame allow the motion of the frame but **external** signals coming from another inertial frame allow determine the motion relative to that frame.

Thus, no coordinate or time transformations are required to "expand" Galileo's principle of relativity.

So, for example, the radio signal of an interplanetary spacecraft relative to the solar frame propagates with the speed C . With respect to the Earth's inertial frame this signal turns out to be external and with the Earth's atmosphere it meets with the speed $C + V$. Entering the atmosphere, the radio signal undergoes a Doppler frequency change and travels relative to the atmosphere at a speed of C / n . In the Earth's inertial frame light and radio signals from terrestrial sources, in accordance with the principle of relativity, propagate in all directions with the same speed C / n and do not allow determining the direction of the Earth's motion.

In 1905, Einstein in his article "On the electrodynamics of moving bodies" **declared** that **there is no ether**, and outlined his special theory of relativity, in which the central place ... is occupied by the **Lorentz transformations**.

The first postulate of this theory extends Galileo's principle of relativity to all phenomena, including optical and electromagnetic: inertial frames are equivalent, distances, time and masses in moving systems change, but these changes are not due to interaction with a stationary ether, but due to some ... special "properties of space and time" **(?!)**. That is, there is no ether, but the parameters in moving inertial systems change in exact accordance with the transformations obtained by Lorentz in the "ether" theory.

The second postulate - the postulate of invariance of the speed of light asserts that the speed of light in emptiness is the same in all inertial systems and does not depend on the severity of the movement of the light **source**, nor on the speed of movement with the **receiver**.

The independence of the speed of light **from the movement of the source** has been proven by all known experiments and observations. But the analysis of all these experiments and observations shows that they prove the independence of the speed of light from the movement of the source not in a void, as SRT claims, but in a real environment. De Sitter's observations prove that light from binary stars at the same speed does not travel in a void, where photons could move at a speed greater than C , but in a real gaseous medium, relative to which, due to the re-emission of photons, light propagates at the same speed C / n independent of the velocities and directions of the stars.

The independence of the speed of light **from the movement of the receiver does not have any confirmation**. In the experiment with a prism, Arago, in principle, could not see the speed $C + V$, because in this experiment the receiver was motionless relative to the medium in which the light propagates (that is, "was motionless relative to the light beam"). No other experiments with the movement of the light receiver have ever been carried out

The lack of experimental confirmation of the independence of the speed of light even only from the movement of the receiver allows us to assert that the **invariance of the light speed** exists only in the article "On the electrodynamics of moving bodies". A description of the experiments in which the receiver of light moves can be found only in our articles, where we propose orbital experiments to refute the invariance postulate [3]. But for some reason, the defenders of the SRT do not want to conduct these experiments.

The most obvious inconsistency of SRT with the actual principle of relativity is manifested in the fact that in all thought experiments of SRT, only signals are used that are sent from one inertial system to another (remember what Galileo warned about?). This is how [the violation of the simultaneity of events](#) is "proved" in the examples with two spaceships, where external signals propagate between moving ships and these signals propagate at the same speed C . What is this? Misunderstanding of the essence of the principle of relativity "or something else? Indeed, in accordance with the principle of relativity, light with a speed C can propagate only inside ships, and external signals relative to the receivers go at different speeds and arrive at them at different times

Messages about "confirmation" of the most important of the three consequences of SRT - time dilation, are constantly appearing. Especially often it is said that "time dilation" is taken into account in the GPS system, which is forced many to abandon criticism of the SRT. However, nothing new is said about other consequences, since the length contraction never was confirmed. And the increase in mass is still proved only by the impossibility of accelerating elementary particles to speeds greater than C , although many have already understood that this is not explained by an increase in mass, but by the fact that fields propagating with a speed of C cannot accelerate something to a speed greater than C ...

The fact that the length of the moving bodies does not decrease will make it possible to prove the laser experiment proposed by us in [4], which practically repeats the one that was performed in 1971 by the French scientist Duguet [5]. The fact that the delays of GPS signals have nothing to do with the myth of time dilation is explained on the basis of purely classical concepts in our work [6].

Conclusion

Lorentz transformations are derived to explain the zero result of Michelson's experiment, provided that the interferometer with the Earth's orbital velocity moves relative to the stationary ether. In the event that the ether does not exist at all, these transformations have no physical meaning and are only of mathematical interest.

Galileo's principle of relativity, provided that there is no ether, satisfies not only mechanical, but also optical and electromagnetic phenomena observed inside the inertial system, and does not hold for external signals traveling between inertial systems. This means that all inertial systems are equivalent and Galileo's principle of relativity does not require any "expansion".

Not understanding the essence of Galileo's principle of relativity, Einstein did not see

the difference between internal and external signals and introduced the postulate of invariance of the speed of light, which was not confirmed by any experiment or observation. Rejecting the ether hypothesis, he stated that the equivalence of all inertial frames, the constancy of the speed of light and the agreement of the principle of relativity with known experiments are ensured by using the same etheric transformations, but all changes in coordinates and time in moving systems do not arise due to interaction with ether, but because of some mystical properties of space and time. The use of "etheric" transformations and the postulate of invariance of the speed of light, not confirmed by experiment, allow us to consider the special theory of relativity and its "consequences" as fundamentally erroneous

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