Theory of Relativity with Two Observers

Ilgaitis Prūsis[1], Peteris Prūsis[2]

Abstract

If there are two observers, then each of them can be considered at rest and everyone else is moving. Both observations individually correspond exactly to the Theory of Relativity, but comparison of their observations is mutually exclusive. This contradiction can only be resolved on the assumption that both observations are apparent, an illusion. The real values are at the rest frame. The TR allow from observations calculate real (rest) values.

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Introduction

In nature, everything is moving: we move around the Earth's surface, the Earth revolves around its axis and the Sun, the Sun revolves around the center of the galaxy, and so on. There is no point in the Universe about that can be said to be in a state of absolute rest. In the Theory of Relativity (TR) is assumed that an observer is in rest frame [1, 2]. If there are several observers, then each of them can be considered at rest

[1] Independent researcher;
[2] Independent researcher

and everyone else is moving. Consider the case of two spaceship A (Alice) and B (Bob) passing each other (Fig.1.).

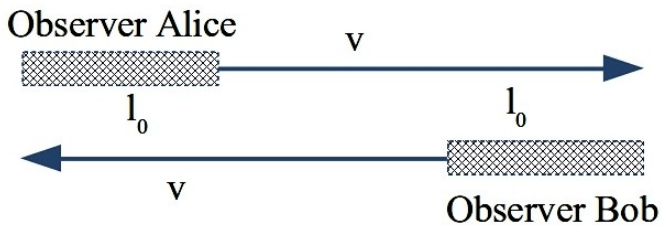

Fig. 1. Two observers.

Length contraction

Alice assumes that she is in a rest frame and Bob is passing at high speed.

What she sees is shown in the Fig. 2.

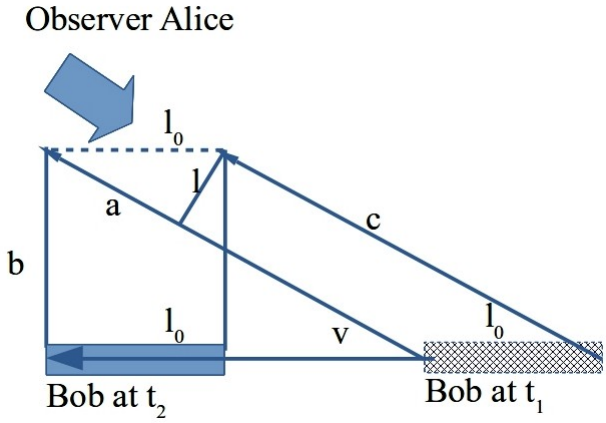

Fig. 2. View from Alice's rest frame.

Bob at t_1 – position of Bob at the time moment t_1 when signal is sent;
Bob at t_2 – position of Bob at time moment t_2 when signal reaches Alice;
v – velocity of object;
l_0 – real length of object;
l – length of object as Alice sees it.

The triangle (**l, l_0, a)** is similar to triangle (**b, c, v)**.

Therefore: $l/l_0 = b/c$. (1)

For right triangle: $b = (c^2 - v^2)^{1/2}$. (2)

From equations (1, 2) it follows: $l = l_0 /(1 - v^2/c^2)^{1/2}$. (3)

As the result, Alice gets the basic equation (3) of the relativity theory. Alice sees that the length of Spaceship B has contracted.

Bob assumes that he is in a rest frame and Alice is passing at high speed.

What he sees is shown in the Fig. 3.

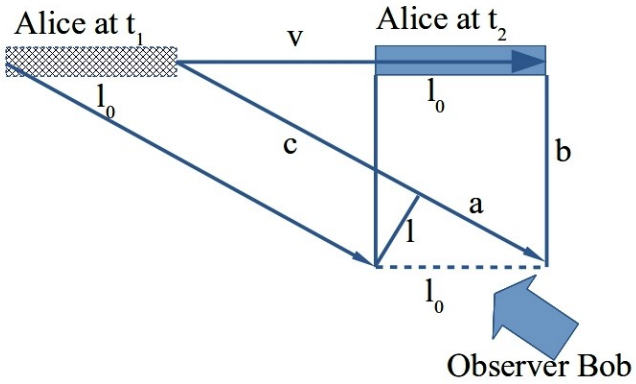

Fig 3. View from Bob's rest frame.

Alice at t_1 – position of Alice at the time moment t_1 when signal is sent;
Alice at t_2 – position of Alice at time moment t_2 when signal reaches Bob;
v – velocity of object;
l_0 – real length of object;
l – length of object as Bob sees it.

The triangle (**l, l_0, a)** is similar to triangle (**b, c, v)**.

Therefore: $l/l_0 = b/c$. (4)

For right triangle: $b = (c^2 - v^2)^{1/2}$. (5)

From equations (4, 5) it follows: $l = l_0 /(1 - v^2/c^2)^{1/2}$. (6)

As the result, Bob gets the basic equation (6) of the relativity theory. Bob sees that the length of Spaceship A has contracted. Flying along the Moon, both Alice and Bob see that the Moon is flat like a pancake (Fig. 4.).

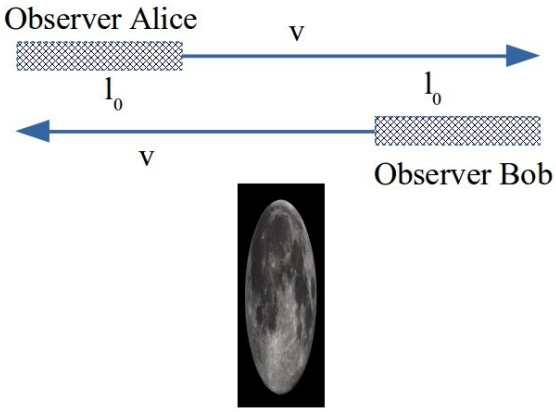

Fig. 4. View of the Moon from Alice and Bob 's spaceships.

Bob performs many experiments and they all confirm that the length in the direction of motion contracts, as predicted by TR. Watching Alice Bob see that her body size changes depending on whether she is standing or sleeping (Fig. 5.).

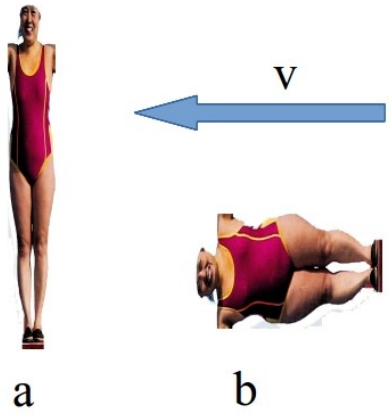

Fig. 5. This is what Bob sees Alice when she stands (a) and when she sleeps (b).

Time dilatation

Length and time can be expressed in the following way:

$$l = v\,t \quad \text{and} \quad l_0 = v\,t_0\,, \qquad (7)$$

where: t – time flow in moving object;
t_0 – time flow in rest frame,
v – velocity of object.

From equation (3) Alice derives: $v\,t = v\,t_0 /(1 - v^2/c^2)^{1/2}$ therefore:

$$t = t_0 /(1 - v^2/c^2)^{1/2} \qquad (8)$$

According to the relativity theory it is the basic equation of time. Alice assumes that she is in rest frame and Bob is moving. So Alice concludes that the time flow on Spacecraft B (Bob) is dilated.

Bob assumes that he is in rest frame and Alice is moving so Bob draws the opposite conclusion from the equation (8), i.e., the time flow in spacecraft B does not change but in Alice's spacecraft the time flow is dilated.

Conclusions

Both Alice and Bob have exactly the same right to assume that she/he is at rest and all other is moving. Both Alice's and Bob's observations individually correspond exactly to the Theory of Relativity, but comparison of their observations is mutually exclusive.

This contradiction can only be resolved on the assumption that both Alice's and Bob's observations are apparent. Observations are an illusion. The real values are at the rest frame. The theory of relativity makes it possible to calculate real (rest) values from observations.

Therefore, length contraction and time dilatation are an illusion that is beneficial to use in science fiction.

References

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Correspondence and requests for materials should be addressed to I.P. (ilgaitis@gmail.com).