

Special relativity (model)

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Abstract

Model of special relativity is built. The model shows the basic formulas of the special relativity and their physical sense.

1 Model of special relativity

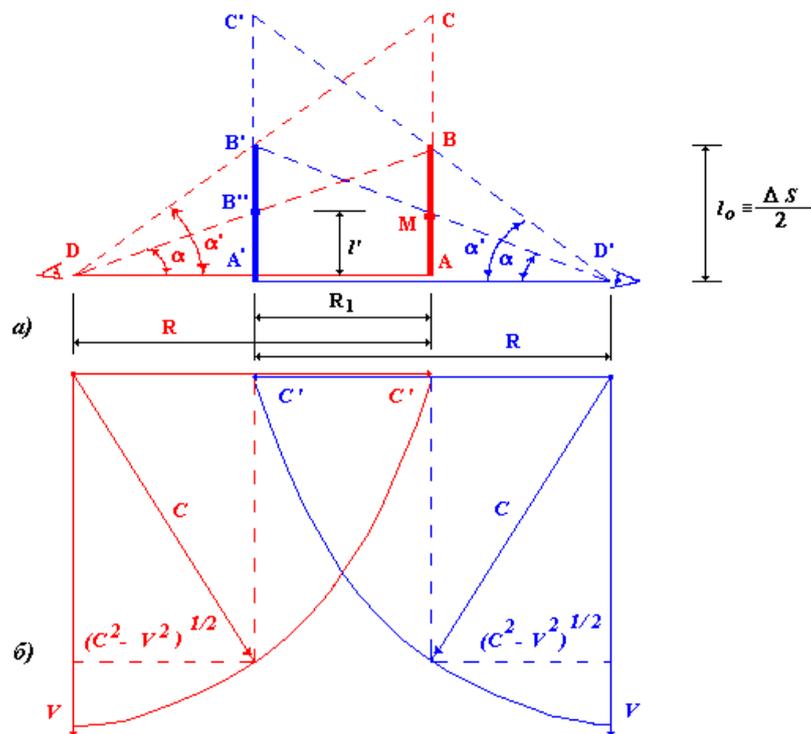


Figure 1: Model of special relativity

Create different kinds of models plays an important role in scientific knowledge . Therefore, the construction of a visual model of the special relativity is of great importance for the explanation of the phenomena (length contraction, time dilation processes) inaccessible to direct perception of human senses.

Model of special relativity is a system of two observers and two rods (Figure 1a). Here AB and $A'B'$ - rods with a length l_0 . At points D and D' are observers. R - permanent distance, R_1 - variable distance. Thus, each observer associated with a respective rod (own reference system indicated in red or blue). From Figure 1a is easy to obtain equations that are valid with respect to both observers

$$l' = l_0 \left(1 - \frac{R_1}{R} \right) \quad (1.1)$$

$$\tan \alpha' = \frac{\tan \alpha}{1 - R_1/R} \quad (1.2)$$

$$R \tan \alpha = \tan \alpha' (R - R_1) = \textit{invariant} \quad (1.3)$$

Suppose that the light signal travels from point A to point B and returns to the point A . Then the formula (1.1), (1.2), (1.3) will have the form

$$l' = l_0 \sqrt{1 - \frac{v^2}{c^2}} \quad (1.4)$$

$$\Delta t' = \frac{\Delta t_0}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (1.5)$$

$$c \Delta t_0 = c' \Delta t' = (c^2 - v^2)^{1/2} \Delta t' = (c^2 \Delta t'^2 - \Delta x'^2)^{1/2} = \Delta S \quad (1.6)$$

Here, l' is a projection of the light beam on the rod $A'B'$; $\Delta t_0 = 2 \tan \alpha (R/c)$ and $\Delta t' = 2 \tan \alpha' (R/c)$ is times of the light signal back and forth; c is speed of light; ΔS is invariant.

Formula (1.4), (1.5) and (1.6) are similar to the formulas of special relativity. Therefore all the conclusions of special relativity clearly displayed in the model.

An illustrative example: observers in the aircraft and on the ground. The size of the aircraft will be reduced and the speed of his movements is slow and vice versa.