the general science journal

Vietnamese Textbook Error in Einstein's Special Relativity

Le Van Cuong
cuong_le_van@yahoo.com

I found mistakes in Einstein's special relativity regarding the velocity of light in the textbook: "**Vat ly dai cuong**", published by "**NXB Giao thong van tai**" in Viet Nam. Now, this textbook: "**Vat ly dai cuong**" is being used to teach Vietnamese university students .

The evidence for these is shown as follows:

First, I translate excerpts in the chapter: "**Co hoc tuong doi**" from Page: 188 to page: 190 .

"*Chương: 13* ,
Thuyết tương đối hẹp Anhstanh (Einstein)"

"*Chapter : 13* ,
Einstein's Special Relativity"
…..

" 13.1 Các tiên đề Anhstanh
Anhstanh xây dựng thuyết tương đối hẹp dựa trên hai tiên đề sau:

1, Định luật vật lý xảy ra như nhau trong các hệ quy chiếu quán tính.
2, Vận tốc ánh sáng trong chân không tương đối với mọi hệ quy chiếu quán tính đều bằng nhau (và bằng 2,99792458.10^8 m/s)"

"13.1 The postulates of Einstein
The following reflections are based on the principle of relativity and on the principle of constancy of light. These two principles Einstein defines as follows:

1, Physical laws are the same in all of the inertial frames of reference.
2, The velocity of light inempty space in all inertial frames are equal to one another (and equal to 2.99792458.10^8 m/s)"
…..

*"Để sử dụng tiên đề thứ 2, khi hai hệ trùng nhau từ O ta phóng ra một tia sáng chạy dọc theo trục x. Nếu đứng trong hệ **K** quan sát ta thấy đầu tia sáng có toạ độ x=ct vì ánh sáng có vận tốc bằng c (≈ 3,10^8 m/s) tương đối với hệ **K**. Nếu đứng trong hệ **K'** quan sát cũng tia sáng đó ta thấy đầu tia sáng có toạ độ* x'=ct' *vì vận tốc của ánh sáng tương đối với hệ **K'** cũng bằng c . Thay x=ct , x'=ct' vào (2.4) , (2.5) ta có*

$$ct' = \alpha (c - V) t$$
$$ct = \alpha (c + V) t'$$

Rút t' *từ phương trình thứ nhất thay vào phương trình thứ hai, ta có:*

$$ct = \frac{\alpha^2}{c}(c^2 - V^2).t$$

Suy ra α bằng $$\alpha = \frac{1}{\sqrt{1 - \frac{V^2}{c^2}}} \qquad (2.6)"$$

"To use second postulate: 2 , when two frames of reference coincide, from O we launch a ray of light, which is along the x axis . If we are in a frame of reference: **K** , we will view first point of ray of light, which has a co-ordinate: x=ct , because the velocity of light in a frame of reference: **K** is equal to c (≈ 3.10^8 m/s). If we are in a frame of reference: **K'** and also view that ray of light, we will view first point of that ray of light, which has a co-ordinate: x'=ct', because the velocity of light in a frame of reference: **K'** is also equal to c . To replace x=ct, x'=ct' into (2.4) , (2.5) , we find that

$$ct' = \alpha (c - V) t$$
$$ct = \alpha (c + V) t'$$

To remove t' from first equation and to replace it into a second equation, we find that:

$$ct = \frac{\alpha^2}{c}(c^2 - V^2).t$$

From this equation, we find α, which is equal to $\alpha = \frac{1}{\sqrt{1 - \frac{V^2}{c^2}}}$ (2.6) "

In an above excerpt of textbook: **Vat ly dai cuong**, the mathematical error and contradiction is where: "To use second postulate: 2 , when two frames of reference coincide, from O we launch a ray of light, which is along axis of x . … . To replace x=ct, x'=ct' into (2.4) , (2.5) , we find that

$$ct' = \alpha (c - V) t$$
$$ct = \alpha (c + V) t' \qquad ."$$

We assume the students find this and ask their teachers as follows:

Using Einstein's second postulate, the velocity of light in the x axis of a frame of reference: K (x, y, z, t) is equal to c ≈ 3.10^8 m/s. This means that a distance x in the x axis of a frame of reference: K (x, y, z, t) is measured by x ≈ 3.10^8 m, and the time: t in the x axis of a frame of reference: K is measured by t ≈ s, (one second: s), because c=x/t . And the velocity of light in the x' axis of a frame of reference: K' (x', y', z', t') is also equal to c ≈ 3.10^8 m/s. It also means that a distance x' in the x' axis of a frame of reference: K' (x', y', z', t') is measured by x' ≈ 3.10^8 m, and the time: t' in the x' axis of a frame of reference: K' is measured by t' ≈ s, (one second: s), because c=x'/t'. Because x≈3.10^8 m and x'≈3.10^8 m , so x = x'. And because t ≈ s and t' ≈ s, so t = t'.

From x' = x and t = t', we find that

ct' = α (c – V) t → c = α (c – V)
ct = α (c + V) t' → c = α (c + V)

Because there is no t' in these equations, we can't have t' so that "To remove t' from first equation and to replace it into a second equation, …", **can we? And because this, we don't do** "From this equation, we find α, which is equal to $\alpha = \frac{1}{\sqrt{1-\frac{V^2}{c^2}}}$ (2.6) ", **do we ?**

How do the teachers answer the students? Which is wrong, Einstein's second postulate or the textbook: **Vat ly dai cuong** is wrong ? Or are the teachers silenced?

What a pity! Since there is this textbook error in Einstein's special relativity, we must be forced to do that or revise the second postulate regarding the velocity of light, which is then not a universal constant, or reject "***Chapter: 13***, **A special relativity of Einstein**" in textbook.

All the authors, who have re-written Special Relativity in textbooks in order to teach the students in Universities, are innocent. This is because Einstein's original paper on special relativity, "**On the Electrodynamics of Moving Bodies**", has the same mistakes. The proof of this is as follows:

In "**On the Electrodynamics of Moving Bodies**"
(http://www.fourmilab.ch/etexts/einstein/specrel/www/), Einstein wrote:

"**§ 2. On the Relativity of Lengths and Times**

The following reflexions are based on the principle of relativity and on the principle of the constancy of the velocity of light. These two principles we define as follows:--

1. The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion.

2. Any ray of light moves in the ``stationary'' system of co-ordinates with the determined velocity *c*, whether the ray be emitted by a stationary or by a moving body. Hence

$$\text{velocity} = \frac{\text{light path}}{\text{time interval}}$$

where time interval is to be taken in the sense of the definition in § 1. "

And " **§ 3. Theory of the Transformation of Co-ordinates and Times from a Stationary System to another System in Uniform Motion of Translation Relatively to the Former**

Let us in ``stationary'' space take two systems of co-ordinates, i.e. two systems, each of three rigid material lines, perpendicular to one another, and issuing from a point. Let the axes of X of the two systems coincide, and their axes of Y and Z respectively be parallel. Let each system be provided with a rigid measuring-rod and a number of clocks, and let the two measuring-rods, and likewise all the clocks of the two systems, be in all respects alike.

Now to the origin of one of the two systems (*k*) let a constant velocity *v* be imparted in the direction of the increasing *x* of the other stationary system (K), and let this velocity be communicated to the axes of the co-ordinates, the relevant measuring-rod, and the clocks. To any time of the stationary system K there then will correspond a definite position of the axes of the moving system, and from reasons of

symmetry we are entitled to assume that the motion of *k* may be such that the axes of the moving system are at the time *t* (this ``*t*'' always denotes a time of the stationary system) parallel to the axes of the stationary system.

We now imagine space to be measured from the stationary system K by means of the stationary measuring-rod, and also from the moving system *k* by means of the measuring-rod moving with it; and that we thus obtain the co-ordinates *x*, *y*, *z*, and ξ, η, ζ respectively. Further, let the time *t* of the stationary system be determined for all points thereof at which there are clocks by means of light signals in the manner indicated in § 1; similarly let the time τ of the moving system be determined for all points of the moving system at which there are clocks at rest relatively to that system by applying the method, given in § 1, of light signals between the points at which the latter clocks are located.

To any system of values *x*, *y*, *z*, *t*, which completely defines the place and time of an event in the stationary system, there belongs a system of values ξ, η, ζ, τ, determining that event relatively to the system *k*, and our task is now to find the system of equations connecting these quantities.

In the first place it is clear that the equations must be *linear* on account of the properties of homogeneity which we attribute to space and time. ”

In using Einstein’s second postulate of the velocity of light, in which c=constant, we find that the velocity of light in system: k with the co-ordinates (x, y, x, t) is equal to $c \approx 3.10^8$m/s. This means that a distance x on the x axis of system: k is measured by $x \approx 3.10^8$m and the time: t in the x axis of the system: k is measured by $t \approx$ s, because c=x/t. And the velocity of light at the system: K with the co-ordinate (ξ , η , ς , τ) is also equal to $c \approx 3.10^8$m/s. It also means that a distance ξ in the ξ axis of system: K is measured by $\xi \approx 3.10^8$m, and the time: τ in the ξ axis of the system: K is measured by $\tau \approx$ s, because c= ξ/τ. Since $x \approx 3.10^8$m and $\xi \approx 3.10^8$m; $t \approx$ s and $\tau \approx$ s, we find that x= ξ and t = τ in any case and anywhere.

That is why, Einstein cannot write:

“**§ 4. Physical Meaning of the Equations Obtained in Respect to Moving Rigid Bodies and Moving Clocks**

We envisage a rigid sphere[6] of radius R, at rest relatively to the moving system *k*, and with its centre at the origin of co-ordinates of *k*. The equation of the surface of this sphere moving relatively to the system K with velocity *v* is

$$\xi^2 + \eta^2 + \zeta^2 = R^2.$$

The equation of this surface expressed in *x*, *y*, *z* at the time *t*=0 is

$$\frac{x^2}{(\sqrt{1 - v^2/c^2})^2} + y^2 + z^2 = R^2.$$

A rigid body which, measured in a state of rest, has the form of a sphere, therefore has in a state of motion--viewed from the stationary system--the form of an ellipsoid of revolution with the axes

$$R\sqrt{1 - v^2/c^2},\ R,\ R. \qquad \text{„}$$

…..

"Between the quantities x, t, and τ, which refer to the position of the clock, we have, evidently, $x=vt$ and

$$\tau = \frac{1}{\sqrt{1-v^2/c^2}}(t - vx/c^2).$$

Therefore,

$$\tau = t\sqrt{1-v^2/c^2} = t - (1-\sqrt{1-v^2/c^2})t \qquad \text{„}$$

This is because if c=constant, (in the system k (x, y, z, t) and in the system K (ξ , η , ς , τ) the velovity of light is c , c=x/t= ξ/τ) , then ξ = x and τ = t in any case and any where. Thus we find that if we envisage a rigid sphere of radius R, at rest relative to the moving system k, and with its centre at the origin of co-ordinate of k , the equation of the surface of this sphere moving relative to system K with velocity v is

$$\xi^2 + \eta^2 + \varsigma^2 = R^2$$

Because ξ = x , the equation of this surface expressed in x, y, z at the time t=o must be

$$x^2 + y^2 + z^2 = R^2$$

The equation can't be $\dfrac{x^2}{\left(\sqrt{1-v^2/c^2}\right)^2} + y^2 + z^2 = R^2$

And because τ = t , the equation can't be $\tau = t\sqrt{1-v^2/c^2} = t - \left(1-\sqrt{1-v^2/c^2}\right)t$

Conclusion:

Obviously, Einstein's second postulate of the velocity of light in which is c=constant, is false and the Vietnamese textbook error in special relativity as well as the mistakes in Einstein's original paper: "**On the Electrodynamics of Moving Bodies**" are real.

An error of Einstein's second postulate of the velocity of light can be neglected and even has no interest. But the Vietnamese textbook error or in any country in the world, we can't neglected. They are used to teach millions of student in the universities throughout the world.

Hanoi, October 4, 2009.