ON THE INVARIANCE OF THE VELOCITY OF LIGHT

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Abstract

The Special Theory of Relativity postulates that the velocity of light would always be invariant at 186,000 miles per second at all inertial frames. The paper examines this aspect of the Theory.

The invariance of the velocity of light as is postulated by the Special Theory of Relativity had been confirmed by many experiments, e.g., the Michelson-Morley experiments. There are however a number of contradictions in Special Relativity. Quite a number of papers have been written about them. The author refers to two papers, namely, Is The Speed Of Light Invariant Or Covariant?, arXiv: 1003.2273, published in March 12, 2010, and, Relativistic Effects Of The Theory Of Reference Frames, Physics Essays, Vol. 20, No. 1, published in 2007, by Daniele Sasso. The author of these two papers has pointed out some contradictions in the Special Theory of Relativity. His Theory of Reference Frames posits that there are actually two velocities of light, one is the physical velocity, which is invariant, the other is the relativistic velocity, which is not invariant but variable depending on the relative velocity among the different frames of reference one adopts, which could be earth itself, the moon, the centre of the universe, etc.. The latter is a contradiction of the important tenet of Special Relativity that the velocity of light is invariant. According to the author of these two papers, no one knows for certain what the absolute frame of reference is, with many postulating that the dubious ether, the theoretical medium in which light travels, is the absolute frame of reference.

The author of this paper would delve further into this contradiction. The Special Theory of Relativity posits that a person on a moving vehicle, e.g., a very fast moving train (moving frame), traveling at close to the velocity of a beam of light (moving frame) in the same direction would find the velocity of the beam of light (moving frame) to be invariant at 186,000 miles per second, instead of the difference between the velocity of the very fast moving train (moving frame) and the velocity of the beam of light (moving frame), which would normally be the case. This is because, according to the Special Theory, on the very fast moving train (moving frame) approaching the velocity of light the clock therein used to gauge the time traveled by the beam of light (moving frame) has slowed down by the same degree as the ruler therein used to gauge the distance traveled by the beam of light (moving frame) has contracted in length in the direction of the very fast moving train’s motion, the greater the very fast moving train's traveling velocity the more the clock slows down and the greater the length contraction of the ruler. This is expressed in the following equation (the velocity of the beam of light (moving frame) being the distance it traveled divided by the time it took to travel this distance), which is in accordance with the Special Theory of Relativity:-

$$\frac{(186{,}000 \text{ miles } - \beta\,\% \text{ of } 186{,}000 \text{ miles})}{(1 \text{ second } - \beta\,\% \text{ of } 1 \text{ second})} = 186{,}000 \text{ miles per second}$$

In other words, there has to be a same percentage decrease in the time gauged and the distance gauged due to the respective slowing down of the clock and contracting in length of the ruler therein the very fast moving train (moving frame), in order for the velocity of the beam of light (moving frame) to remain invariant, which is consistent with mathematical logic - this condition has to apply in order for the velocity of the beam of light (moving frame) to remain invariant. It should be noted here that having the same percentage decrease in the time gauged and the distance gauged, as is shown in the above equation, seems an improbable occurrence.

There is however something rather unusual related to the above concept. According to the Special Theory of Relativity, the person on the very fast moving train traveling at close to the velocity of light (moving frame) gauging the velocity of the beam of light traveling in the same direction (moving frame) would not notice that the clock on his very fast moving train (moving frame) has slowed down and the ruler therein has contracted in length in the direction of motion. In other words, everything would appear normal to him, despite the fact that his clock has actually slowed down and his ruler has actually contracted in length in the direction of motion, as is postulated by the Special Theory of Relativity. But, according to the Special Theory of Relativity, when he (moving frame) compares himself to a person on the ground who is not moving (stationary frame), he could even consider himself stationary (stationary frame) while thinking that the person on the ground (who is not moving) is actually moving (moving frame), i.e., all movements are relative. He (moving frame) would notice that the clock on the ground (stationary frame) is slower and the ruler on the ground (stationary frame) is shorter. The person on the ground who is not moving (stationary frame) would also notice that the clock on the very fast moving train (moving frame) is slower, the ruler therein is shorter, and, the length of the very fast moving train (moving frame) is shorter. In other words, both the train-traveler (moving frame) and the person on the ground who is not moving (stationary frame) would notice that the other's clock is slower and the other's ruler is shorter, and, according to the Special Theory of Relativity, the slowing down of clocks and the shortening of rulers would appear to be by the same degree for both.

But, it is actually the clock on the very fast moving train traveling at close to the velocity of the beam of light in the same direction (moving frame) which has slowed down and the ruler therein which has contracted in length (in the direction of motion) as is postulated by the Special Theory of Relativity, and not those on the ground (stationary frame). To the traveler on the very fast moving train (moving frame) who is gauging the velocity of the beam of light traveling in the same direction (moving frame), the beam of light (moving frame) appears to take less time (time dilation) to travel a shorter distance (length contraction), which, according to the Special Theory of Relativity and in accordance with the following equation, explains the invariance of the velocity of light at all inertial frames:-

$$\frac{(186{,}000 \text{ miles} - \beta\,\% \text{ of } 186{,}000 \text{ miles})}{(1 \text{ second} - \beta\,\% \text{ of } 1 \text{ second})} = 186{,}000 \text{ miles per second}$$

The velocity of the beam of light (moving frame) is obtained by dividing the distance traveled by the beam of light (as gauged by the ruler on the very fast moving train traveling at close to the velocity of light - moving frame) by the time it took to travel that distance by the beam of light (as gauged by the clock therein the very fast moving train - moving frame), the gauging being carried out by the traveler on the very fast moving train (moving frame). In the above example, the clock on the very fast moving train traveling at close to the velocity of light (moving frame) slows down and gauges a slower time, β % slower. The ruler therein also contracts in length in the direction of motion by β %; however because of this it should gauge any object as “longer” due to a change in the scale of the ruler on contracting in length in the direction of motion (refer to Appendix at the back), and, this evidently gives rise to an inconsistency when computing the velocity of the beam of light (moving frame). This inconsistency in the computation of the velocity of light is described in the example below.

The person on the very fast moving train (moving frame) traveling at close to the velocity of the beam of light (moving frame) in the same direction could be considered one inertial frame, and, the ground level (stationary frame) could be considered another inertial frame. If, traveling at close to the velocity of light, both his clock has slowed down and his ruler has contracted in length in the direction of motion by the same degree (β %), the beam of light (moving frame) whose velocity he is gauging, according to the Special Theory of Relativity, would also appear to him to have traveled a distance (from one designated point (Point A) to another designated point (Point B) - reference, stationary frame) which is shortened by the same degree (β %), i.e., the distance between the two designated points Point A & Point B (reference, stationary frame) traveled by the beam of light appears to him to have shortened by the same degree (β %). We would describe below what happens when the train-traveler traveling at close to the velocity of light gauges the velocity of the beam of light traveling alongside his train in the same direction:-

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reference      l---------------------------------------------------------------l
frame          A                                                               B

beam of light  --------------------------------------------------------------->

train-traveler/ --------------------------------->
train
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(1) We first recapitulate and make clear the following conditions which are stipulated by the Special Theory of Relativity:

(a) Clocks slow down and rulers contract in length in the direction of motion, at close to the velocity of light, but these would not be noticed by the person traveling at close to the velocity of light (moving frame) who possesses such clocks and rulers. These do not apply to the clock and ruler of the person on the ground who is not moving (stationary frame).

(b) The train-traveler traveling at close to the velocity of light (moving frame) and the person on the ground who is not moving (stationary frame) would notice one another's clock and ruler as respectively slower and shorter than his own. Both of them would each notice the other's clock slowing down and ruler length shortening to the same degree (β % for the clock and ruler of the train-traveler traveling at close to the velocity of light (moving frame) and also β % for the clock and ruler of the person on the ground who is not moving (stationary frame)). Though the train-traveler's clock has slowed down and his ruler has contracted in length in the direction of motion while he is traveling at close to the velocity of light, as is described in (a) above, he would not notice these happenings. All this does not apply to the clock and ruler (which are not affected by (a) above) of the person on the ground who is not moving (stationary frame).

(c) All movements are relative. When the train-traveler traveling at close to the velocity of light (moving frame) compares himself to a person on the ground who is not moving (stationary frame), he could consider himself stationary (stationary frame) while thinking that the person on the ground (who is not moving) is actually moving (moving frame) - both parties could each regard themselves as stationary (stationary frame) and consider the other party in motion (moving frame).

(d) The train-traveler traveling at close to the velocity of light (moving frame) would see the distance from Point A to Point B at the embankment besides the railway tracks (reference, stationary frame - you might substitute this distance with a ruler) traveled by the beam of light whose velocity he is gauging as having shortened. This shortening (by β %) of the distance from Point A to point B (reference, stationary frame) would be by the same degree as his own clock has slowed down (β %) and his own ruler has contracted in length in the direction of motion (β %), both of which he does not notice. This point is the equivalent of Point (b) above.

(e) The velocity of the beam of light (moving frame) is obtained by dividing the distance traveled by the beam of light (as gauged by the ruler on the very fast moving train traveling at close to the velocity of light - moving frame) by the time it took to travel that distance by the beam of light (as gauged by the clock therein the very fast moving train - moving frame), the gauging being carried out by the traveler on the very fast moving train (moving frame), the greater the very fast moving train's traveling velocity the more the clock slows down and the greater the length contraction of the ruler. For the velocity of the beam of light (moving frame) to be measured as invariant, the clock in the train traveling at close to the velocity of light (moving frame) used to gauge the time traveled by the beam of light (moving frame) has to gauge a time which has slowed down by the same degree (β %) as the distance traveled by the beam of light (moving frame) which has shortened (also β %) as is gauged by the ruler therein.

(2) The following is what happens when the train-traveler's clock and ruler slows down and contracts in length in the direction of motion respectively by 50 % each and the distance from Point A to Point B (reference, stationary frame) traveled by the beam of light whose velocity the train-traveler is gauging has shortened by 50 % in his eyes:

(a) Before the distance from Point A to Point B (reference, stationary frame) traveled by the beam of light has shortened by 50 % (as is gauged at the ground level - stationary frame):

(i) Distance from Point A to Point B (reference, stationary frame) = 1 metre
(ii) Time taken by the beam of light (moving frame) to travel this 1 metre = x second, i.e., velocity of the beam of light (moving frame) = 1 metre per x second

The above distance of 1 metre in (i) is gauged at the ground level (stationary frame) with a ruler which has not contracted in length (by 50 %, as yet). The above time of x

second in (ii) is gauged at the ground level (stationary frame) with a clock which has not slowed down (by 50 %, as yet).

(b) (i) After the ruler on the moving train (moving frame) has contracted in length in the direction of motion by 50 %, it would gauge the above-mentioned 1 metre (distance from Point A to Point B (reference, stationary frame), before shortening) traveled by the beam of light as 2 metres. (A shortened ruler gauges an object as “longer” while a lengthened ruler gauges an object as "shorter", due to the different scales, as is explained in the Appendix.)

(ii) After the clock on the moving train (moving frame) has slowed down by 50 %, at the same time that the ruler has contracted in length by 50 %, it would gauge the above-mentioned *x* second taken to travel this measured distance of 2 metres as 1/2 *x* second.

(iii) That is, the beam of light (moving frame) is now gauged from the moving train (moving frame) as requiring 1/2 *x* second to travel the distance of 2 metres (before the shortening of the distance between Point A & Point B (we assume here that the distance between Point A & Point B has not shortened) - in accordance with the Special Theory of Relativity this distance would also be shortened (also by 50 %) as seen by the train-traveler, as is described below); this translates into a velocity of 4 metres per *x* second, or, 4 times velocity of light.

(c) After the distance from Point A to Point B (reference, stationary frame) traveled by the beam of light has shortened by 50 %, as is seen by the train-traveler traveling at close to the velocity of light (moving frame), in accordance with the Special Theory of Relativity:

(i) The 1-metre ruler which has contracted in length in the direction of motion by 50 % would gauge the above-mentioned 50 % shortened distance from Point A to Point B (reference, stationary frame) as 50 % shorter than before (i.e., 0.5 metre instead of 1 metre), and would read "0.5 metre" (instead of "1 metre" - full length of the 1-metre ruler) on its 50 % shortened length, which is in accordance with the Special Theory of Relativity. (The ruler now has a different scale as compared to its scale before length contraction. Refer to Appendix for explanation.)

(ii) When the scale of the ruler has changed due to the ruler's length contraction (by 50 %), and the clock has slowed down (by 50 %), the beam of light (moving frame) being gauged as requiring 1/2 *x* second to travel the distance of 2 metres, as is described in (b) (ii) above, the time taken by the beam of light (moving frame) to travel 0.5 metre now = (0.5 metre ÷ 2 metres) x 1/2 *x* second = 1/8 *x* second, i.e., the velocity of the beam of light (moving frame) is now 0.5 metre per 1/8 *x* second, or, 4 metres per *x* second/4 times velocity of light, which is an inconsistency (the velocity of the beam of light should have remained 1 metre per *x* second/1 time velocity of light, as is postulated by the Special Theory of Relativity).

The computations above have been carried out in accordance with the conditions stipulated by the Special Theory of Relativity which are described in (1) above. The above inconsistency is evidently due to the change of the scale of the ruler which has contracted in length in the direction of motion by 50 %. It requires attention.

In order for the velocity of the beam of light to remain/appear invariant in this instance, i.e., remain at 1 metre per *x* second, one of the following has to happen:-

1) When the clock slows down by 50 %, the ruler should increase in length by 100 %.
2) When the ruler decreases in length by 50 %, the clock should quicken by 100 %.
3) When the clock slows down by 50 % and the ruler decreases in length by 50 %, the beam of light (moving frame) should slow down by 400 %.

How do we explain the invariance of the velocity of light at all inertial frames if as described above there is an inconsistency relating to length contraction? The postulates of the Special Theory of Relativity evidently imply that the invariance of the velocity of light at all inertial frames is only an illusion - if the velocity of light were to *appear* invariant, according to the Theory, lengths have to contract (Lorentz contraction) and clocks have to slow down (time dilation), at the same rate, while moving at close to the velocity of light. We here ask the important question: If lengths do not contract and clocks do not slow down at close to the velocity of light, as are postulated by the Theory, would the velocity of light still appear invariant? In all this, we should also bear in mind that while the slowing down of clocks (time dilation) when traveling at high velocities is an experimentally proven phenomenon length contraction (Lorentz contraction) has not been experimentally proven and remains an inference. In view of the above-mentioned inconsistency, there could be another explanation or reason for the invariance of the velocity of light at all inertial frames, e.g., length expansion, as is described above, or, some other valid reasons. We have to find a fool-proof reason or reasons to explain why the velocity of light always appears invariant at all inertial frames, which would corroborate the experimental evidence that the velocity of light is invariant.

There is an evident way out of this difficulty or dilemma, which would be described here. Let us here recapitulate the important point brought up above, which is as follows:-

In order for the velocity of the beam of light to remain/appear invariant, i.e., remain at 1 metre per *x* second, one of the following has to happen:

1) When the clock slows down (time dilation) by *x* %, the ruler should increase in length (length expansion) by *y* %.
2) When the ruler decreases in length (length contraction) by *x* %, the clock should quicken (time contraction) by *y* %.
3) When the clock slows down (time dilation) by *q* % and the ruler decreases in length (length contraction) by *q* %, the beam of light (moving frame) should slow down by *r* %.

We would add a fourth option to the above three options, which is as follows:

4) When the clock slows down (time dilation) by *q* % and the ruler remains the same in length (unchanged in length) if Lorentz contraction were not an actuality and does not happen, the beam of light (moving frame) should slow down by *s* %. (s % < r %)

Since the phenomenon of clocks slowing down (time dilation) while traveling at high velocities had been confirmed by experiments and length contraction has not been confirmed experimentally as yet but is an inference only, Item (2) above (which states clock quickening, an unproven phenomenon and the reverse and contradiction of the experimentally proven clock slowing down phenomenon (time dilation)) could be ruled out, while Items (1), (3) and (4) are possibilities, however remote these possibilities might be. Though the intense gravitational field caused by travel at almost the velocity of light might account for the slowing down of clocks (for which experimental evidence had already been obtained as is stated above) and therefore time, as well as the brain and bodily functions of a person, it evidently hardly suffices as an explanation for length contraction (for which experimental evidence has yet to be found).

We should remember that length contraction is after all an unconfirmed inference (unlike time dilation which had been proven by experiments as is stated above). The same would apply to length expansion. There is probably no such things as length contraction or length expansion. It is difficult to envision or imagine a rigid object such as a ruler or metre rod contracting in length or expanding in length as though it is made of rubber, which is flexible, and such a phenomenon should be regarded as improbable; length contraction and length expansion could therefore be regarded as only illusions at most, more apparent than real. Because of this, Items (1) and (3) above would appear remotely probable with Item (2) completely ruled out as is stated above, while Item (4) is most probable. But Item (4) above implies that the velocity of light would appear to exceed the 186,000 miles per second limit (the slowed down clock (“time dilated” clock) and the ruler which remains the same in length (does not contract in length) would now together gauge the velocity of the beam of light (which is actually 186,000 miles per second) as more than 186,000 miles per second - as the clock has slowed down (time dilation), the beam of light would now (appear to) take less time to travel the same distance, i.e., the velocity of the beam of light now appears to be greater, this higher velocity being determined by dividing the distance traveled by the time taken to travel this distance), 186,000 miles per second being the limit of the velocity of light which is postulated by the Special Theory of Relativity - the velocity of light could never exceed this limit as is postulated by the Theory. Thus, the above is evidently an *illusion* caused by the slowing down of the clock while the length of the ruler remains unchanged (does not contract), both the clock and the ruler having been utilised to gauge the velocity of the beam of light. That is, Item (4) above would produce the *illusion* of the beam of light (which has an actual velocity of 186,000 miles per second) having a velocity of more than 186,000 miles per second. All this would be another "headache" for the Special Theory of Relativity, which states that no moving object including light could exceed the velocity limit of 186,000 miles per second. As is stated in Item (4) above, in order for the slowed down clock (slowed down by *q* % for example) and the ruler whose length has not contracted but remains the same to gauge the velocity of the beam of light as invariant (invariant at 186,000 miles per second), the actual velocity of the beam of light has to be less than 186,000 miles per second (the beam of light should slow down by *s* %, as is stated in Item (4) above); this would of course result in the *illusion* that the velocity of the beam of light is invariant (unchanged at 186,000 miles per second) while the actual velocity of the beam of light is less than 186,000 miles per second - if the clock used to gauge the velocity of the beam of light (which is actually less than 186,000 miles per second, say *d* miles per second) had not slowed down (time dilation) but remained ticking at the same rate, the velocity measured would certainly be less than 186,000 miles per second (which is as stated just above the actual velocity, i.e., *d* miles per second).

However, of the four options above, Items (1), (2), (3) and (4), Item (4) is hence evidently the most realistic and probable. We recapitulate here: Item (4) states that there is time dilation but no length contraction, i.e., clocks would slow down at high velocities, e.g., velocities close to the velocity of light, but at such high velocities rulers would not contract in length in the direction of motion and would remain the same in length. Based on these conditions of Item (4), there is a logical, more sensible explanation for the invariance of the velocity of light, which would be described in the following:-

A person on a moving vehicle, e.g., a very fast moving train (moving frame), traveling at close to the velocity of a beam of light (moving frame) in the same direction would find the velocity of the beam of light (moving frame) to be invariant at 186,000 miles per second, instead of the difference between the velocity of the very fast moving train (moving frame) and the velocity of the beam of light (moving frame), which would normally be the case. This is because, according to the Special Theory of Relativity, on the very fast moving train (moving frame) approaching the velocity of light the clock therein used to gauge the time traveled by the beam of light (moving frame) has slowed down by the same degree (say β %) as the ruler or measuring device (stated as meter stick or measuring rod in some texts) therein used to gauge the distance traveled by the beam of light (moving frame) has contracted in length in the direction of the very fast moving train's motion (also *β* %), the greater the very fast moving train's traveling velocity the more the clock slows down and the greater the length contraction of the ruler or measuring device. This is expressed in the following equation (the velocity of the beam of light (moving frame) being the distance it traveled divided by the time it took to travel this distance), which is in accordance with the Special Theory of Relativity:

$$\frac{(186{,}000 \text{ miles} - \beta\,\% \text{ of } 186{,}000 \text{ miles})}{(1 \text{ second} - \beta\,\% \text{ of } 1 \text{ second})} = 186{,}000 \text{ miles per second}$$

The explanation in this case for the invariance of the velocity of light is based on the conditions stipulated in Item (3) above, wherein length contraction is evidently not so probable, as is explained above. Also, to have length contraction and time dilation happen to the same degree (shown in the above equation as *β* % each) is not that probable. We would re-construe this case using the more realistic and probable conditions stated in Item (4) above, namely, time dilation, which is a proven phenomenon, and absence of length contraction, which is to be expected. We would use a simple diagram to explain, which is as follows:

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reference       l-----------------------------------------------------------------l
frame           A                                                                 B

                              velocity = 1 metre per x second
beam of light  ------------------------------------------------------------------>

                    velocity = 2/3 meter per x second
train-traveler/ ----------------------------------------------->
train
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The above train-traveler traveling at two-third the velocity of light besides a beam of light in the same direction is gauging the velocity of the beam of light. The velocity of the beam of light is 1 metre per *x* second while the velocity of the train, being two-third the velocity of light, is 2/3 metre per *x* second. Under normal circumstances, the train-traveler would gauge the velocity of the beam of light traveling in the same direction besides his train as 1/3 metre per *x* second, obtained by deducting the velocity of the train from the velocity of the beam of light, i.e., 1 metre per *x* second minus 2/3 metre per *x* second. But, the train-traveler is now experiencing some abnormal conditions while traveling at two-third the velocity of light, i.e., 2/3 metre per *x* second, as, by Item (4) above, his clock slows down while his ruler or measuring rod remains unchanged in length (does not experience length contraction). Say, e.g., the train-traveler's clock has slowed down by two-third while his ruler or measuring rod remains the same in length, while traveling at two-third the velocity of light, or, 2/3 metre per *x* second. The train-traveler's unchanged ruler or measuring rod would now gauge 1/3 metre (the velocity of the beam of light should be 1/3 metre per *x* second under normal circumstances as is stated above) as 1/3 metre still but his clock which has slowed down by two-third would now gauge the time taken to travel the distance of 1/3 metre as 1/3 *x* second (and not x second), i.e., the train-traveler would now gauge the velocity of the beam of light traveling in the same direction besides his train as 1/3 metre per 1/3 *x* second, which is the same as 1 metre per x second, which is the velocity of light! Thus, to the train-traveler, the velocity of the beam of light traveling in the same direction besides his train is invariant, i.e., still 1 metre per *x* second, instead of 1/3 metre per *x* second. Therefore, the conditions of Item (4) above, namely time dilation and absence of length contraction, could be incorporated into a revised Special Theory of Relativity, whereby the inconsistency described above would be gone.

Thus, with length contraction (Lorentz contraction) out of the equation and with time dilation still playing a role, the above-described inconsistency evidently does not arise.

The other reason put forward by the Special Theory of Relativity for the invariance of the velocity of light is that light is unaffected by its source. The velocity of light would be invariant if gauged from different inertial frames, e.g., when the velocity is gauged when the beam of light is emitted from a source which is stationary (not moving), for instance, the headlight of a stationary car, and, when the velocity is gauged when the beam of light is emitted from a source which is moving, for instance, the headlight of a moving car - in both these instances the velocity of the beam of light would be the same, as is postulated by the Special Theory of Relativity, though common sense dictates that in the second instance, the instance of the moving car, the velocity of the beam of light should be the velocity of the beam of light (186,000 miles per second) plus the velocity of the car (say 0.014 miles per second), giving a total velocity of 186,000.014 miles per second. The answer to this abnormality, according to the Special Theory of Relativity, is that the beam of light is independent of its source, the car headlight, and is not affected by this source. This implies that if the car were to travel at a higher velocity than the velocity of the beam of light the car would be moving in front of the beam of light, while the beam of light would be tagging behind the car.

However, by the many experimental results, e.g., the Michelson-Morley experiments, the velocity of light should be invariant, but, a fool-proof theory is needed to explain it.

APPENDIX

We here consider a map of size *p* feet in length by *q* feet in breadth with a scale of 1 is to 100,000 (1 inch on the map represents 100,000 inches on the actual ground) which shows only a portion of our globe. To have the whole globe represented in this map *p* feet in length by *q* feet in breadth, it is evident that we have to change its scale, e.g., change its scale to 1 is to 1,000,000 (1 inch on the map represents 1,000,000 inches on the actual ground). The above-mentioned ruler which has contracted in length is analogous to a map whose scale has been changed to allow it to represent a larger area (i.e., the whole globe), e.g., from 1 is to 100,000 to 1 is to 1,000,000 - with the new scale of 1 is to 1,000,000, 1 inch on the map now represents a length of 1,000,000 inches instead of 100,000 inches on the actual ground. If we change the scale of the above-mentioned map which shows only a portion of our globe to 1 is to 1,000,000 from 1 is to 100,000, we would have a much smaller map showing the same portion of our globe, whose dimensions would be 1/10 *p* feet in length by 1/10 *q* feet in breadth, a contracted map which is analogous to the above-mentioned ruler which has contracted in length. A 1-metre-long ruler which has contracted in length by 50 %, e.g., would now gauge the length of 1 metre as 2 metres (and not 0.5 metre in accordance with the Special Theory of Relativity), and this is evidently the cause of the above-described inconsistency relating to the computation of the velocity of light. In fact, for the 1-metre-long ruler to gauge the length of 1 metre as 0.5 metre it would have to increase in length by 100 %. A shortened ruler would gauge an object as “longer” while a lengthened ruler would gauge an object as “shorter”.

Let us look at a simple example here. For instance, the 1-metre-long ruler used to gauge distance has contracted in length in the direction of motion by 20 %. The clock used to gauge time, which has also slowed down by 20 %, according to the Special Theory of Relativity, would now gauge the time taken, say *t*, to travel the distance between two designated points (reference, stationary frame), say *u*, as having decreased by 20 % to become 0.8 *t*. Though the 1-metre-long ruler, which has contracted in length by 20 %, still reads “1 metre” in length, it is in effect shorter by 20 % (actually only 0.8 metre in length). Therefore, when it gauges the distance traveled, *u*, above, this distance *u* would now be gauged as 1.25 *u*, and not 0.8 *u* in accordance with the Special Theory of Relativity. As stated above, the Special Theory of Relativity theorizes that for a beam of light (moving frame) to remain invariant in velocity the beam of light (moving frame) has to take less time (time dilation) to travel a shorter distance (length contraction) - in effect, β % less time to travel a distance shorter by β %, in accordance with the following equation, which implies that the velocity of the beam of light (moving frame) would remain invariant, e.g., 0.8 *t* (time) to travel 0.8 *u* (distance) after “time dilation” and “length contraction”:-

$$\frac{(186{,}000 \text{ miles} \;-\; \beta\,\%\text{ of } 186{,}000 \text{ miles})}{(1 \text{ second} \;-\; \beta\,\%\text{ of } 1 \text{ second})} \;=\; 186{,}000 \text{ miles per second}$$

But, as explained above, this would not be the case; the beam of light (moving frame) would have been gauged as having taken 0.8 *t* (time) to travel 1.25 *u* (distance). This is an inconsistency in the Special Theory of Relativity.

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