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Letter

The Myth of Remote Non-simultaneity: Newton Was Right and Einstein Was Wrong

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Letter to the Editor:

The Lorentz transformation (LT) is the cornerstone of Einstein's Special Theory of Relativity (STR) [1]. Both the relativistic velocity transformation (RVT), which is derived from the LT by simply taking the ratios of its space and time coordinates, and the LT itself guarantee satisfaction of Einstein's light-speed constancy postulate as well as the Relativity Principle (RP). Despite the many successes of STR, however, it is easy to show that it is irretrievably flawed. This is clearly seen by noting that two of the most famous predictions of the LT, remote non-simultaneity and proportional time dilation of clock rates, are self-contradictory.

The example of two lightning strikes occurring at different locations [2], which Einstein used to argue in favor of the non-simultaneity prediction, clearly illustrates the problem with the LT. According to the latter's prediction, the time differences Δt and $\Delta t'$ between the two lightning strikes measured by a pair of observers must satisfy the following proportionality relationship: $\Delta t=X\Delta t'$ [3], whereby it is claimed that the constant X can only be a function of the relative speed v of the two observers.

Yet, the remote non-simultaneity prediction of the same theory states that if the lightning strikes occur simultaneously for one observer ($\Delta t'=0$), it is impossible for the other to find that they also occur at the same time for him ($\Delta t\neq 0$). The above two conditions cannot both be satisfied for the same pair of events. This is easily seen [4] by substituting the null value of $\Delta t'$ in the $\Delta t=X\Delta t'$ time-dilation equation. The result is clearly that $\Delta t=0$, thereby contradicting the remote non-simultaneity prediction that Δt must be different from zero. Any other value for Δt stands in direct contradiction to the axiom of elementary algebra which states that the result of multiplying any finite number with zero is itself equal to zero.

The fact that these two effects are incompatible with each other proves that the LT is not a valid component of relativity theory since both are derived directly from it. There is a simple way to correct the situation, however. To do this it is helpful to consider the following argument based on Newton's First Law of Motion (Law of Inertia). The latter states that an object such as an atomic clock will move in a straight line with constant speed in the absence of unbalanced external forces. However, this assertion raises a question about the properties of the clock under these circumstances? It is certainly reasonable to assume that they will all remain unchanged until some new force acts on the clock (Law of Causality).

This means, for example, that the rate of the clock must be expected to remain constant as long as it remains

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in free translational motion. The rate of one such clock might not be the same as its counterpart in a different state of motion, however, but if both rates are constant, it follows that the ratio Q of their rates must also be constant. The conclusion is therefore that elapsed times Δt and $\Delta t'$, such as those mentioned above for the time difference between lightning strikes measured by two observers, must be directly proportional to one another, i.e. $\Delta t' = \Delta t/Q$ (Newtonian Simultaneity). This conclusion is obviously inconsistent with remote non-simultaneity. It is also inconsistent with the space-time mixing characteristic of the LT which has become dogma for theoretical physicists.

The above conclusion is also incompatible with another key prediction of Einstein's theory, symmetric time dilation. In this case, according to the LT, two observers in motion must disagree as to which one has the slower clock. Specifically, the theory predicts that it is always the "other's" clock that runs slower. Since Q is a constant in the above argument based on Newtonian Simultaneity, it follows that it should always be possible in principle to know which clock runs slower. The answer depends solely on whether the constant Q has a value which is greater or less than unity ($Q>1$ or $Q<1$).

Experiments carried out with circumnavigating clocks [5] are in complete accord with this conclusion [6,7]. Specifically, the Hafele-Keating study found that the rate of a given clock was inversely proportional to $\gamma(v) = (1-v^2c^{-2})^{-0.5}$, where v is its speed relative to the earth's center of mass (c is the speed of light in free space, 299792458 ms^{-1}). The above constant Q is seen to be equal to the ratio of $\gamma(v)$ factors for any two clocks in the experiment [6,7]. An analogous inverse proportionality relationship was found earlier in x-ray frequency measurements employing a high-speed rotor [8], in which case the speed of the "clock" was measured relative to the rest frame of the rotor axis. These results can be summarized in the equation below for two clocks moving with speeds v and v', respectively. It has been referred to as the Universal Time-dilation Law or UTDL [7]:

$$\Delta t'\gamma(v')=\Delta t\gamma(v).$$

The same relationship is used [9,10] in the operation of the Global Positioning System (GPS) in order to adjust the rates of atomic clocks on satellites to be equal to those of counterparts on the earth's surface. The accuracy of this navigation system, which is routinely used in everyday life, lends unwavering support to the validity of the UTDL.

In the past it has been assumed by physicists that the space-time mixing characteristic of the LT is essential in order for a transformation to satisfy the light-speed constancy postulate[1]. This view has been shown to be false over a decade ago, however [11,12]. An alternative version of the LT exists which is referred to variously as the Global Positioning System-Lorentz Transformation (GPS-LT) [4] or Newton-Voigt Transformation (NVT) [6]. It also satisfies both of Einstein's postulates of relativity, but while also employing the Newtonian proportionality relation $\Delta t' = \Delta t/Q$ directly as one of its four equations. The NVT embodies the UTDL of eq. (1) by using it to define the constant Q as $\gamma(v')/\gamma(v)$ [13]. It is also fully compatible with the same velocity transformation (RVT) derived from the LT, thereby demonstrating its compliance with Einstein's second postulate of relativity.

The situation is easy to understand. The LT is beloved by physicists, but has also been shown by the above argument to be invalid as a consequence of its prediction of remote non-simultaneity. Replacing the LT with the NVT offers a simple solution to the dilemma posed by this state of affairs, but this requires that physicists give up on the idea of space-time mixing once and for all. Taking a look at any of the many standard textbooks on relativity, including the relevant Wikipedia section, shows that the required changes would have to be made very early on, specifically at the point where the LT is usually defined. After that, any and all conclusions based exclusively on the LT would have to be either deleted or substantially modified. Einstein's famous $E=mc^2$ relation, with its many experimental verifications, is unaffected since the changes only involve space and time variables. FitzGerald-Lorentz length contraction would have to be eliminated as well, however; the NVT requires that isotropic length expansion must accompany Newtonian time dilation in order to remain consistent with the constancy of the speed of light.

Will the required changes ever make it into mainstream journals and documentaries? That is a goal that

will hopefully be vigorously pursued in the very near future. A significant part of Einstein's legacy is at issue. It is simply unacceptable that any theory rest on the claim that multiplying a number with zero can give a non-zero result.

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Conflict of Interest

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