The Myth of Remote Non-simultaneity:

Newton Was Right and Einstein Was Wrong

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The Lorentz transformation (LT) is the cornerstone of Einstein's Special Theory of Relativity (STR) [1]. Two of its most famous predictions are time dilation (the slowing down of clocks) and remote non-simultaneity in different rest frames. In addition, the relativistic velocity transformation (RVT) is derived from the LT by simply taking the ratios of its space and time coordinates The RVT guarantees satisfaction of Einstein's light-speed constancy postulate. Despite the many successes of this theory, however, it is easy to show that it is irretrievably flawed. This is because remote non-simultaneity is incompatible with time dilation, as discussed below.

The example of two lightning strikes [2], which Einstein used to argue in favor of the non-simultaneity prediction, illustrates the problem. According to the LT prediction of time dilation, the time differences Δt and $\Delta t'$ between the two lightning strikes that are measured by a pair of observers who are moving relative to one another must be directly proportional to one another, i.e. $\Delta t = X \Delta t'$ [3]. It is claimed that the proportionality constant X is only 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

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for the other to find that they also occur at the same time for him ($\Delta t \neq 0$). *The two conditions cannot both be satisfied for the same pair of events, however.* This is easily seen 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. *Any other value for Δt is inconsistent with the axiom of 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 logical argument involving Newton's First Law of Motion. The latter states that an object such as an atomic clock will move in a straight line with constant speed if it is not under the influence of unbalanced external forces. What 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 the object is 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 based on Newton's First Law (and also the Law of Causality) 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. $\Delta t' = \Delta t / Q$. This conclusion is obviously inconsistent with remote non-simultaneity. It is also inconsistent with the space-time mixing characteristic of the LT that 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 Newton's First Law, 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 [4] are in complete accord with this conclusion. 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. An analogous inverse proportional relationship was found earlier in x-ray frequency measurements employing a high-speed rotor [5], 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 [7,8] in the operation of the Global Positioning System 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 experience, 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 [9,10]. An alternative version of the LT exists which is referred to as the Global Positioning System-Lorentz Transformation (GPS-LT). 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 GPS-LT embodies the UTDL of eq. (1) by using it to define the constant Q as $\gamma(v')/\gamma(v)$ [11]. 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 GPS-LT 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. Those that involve the RVT directly, such as the aberration of star light at the zenith and the explanation for the Fresnel light-drag phenomenon, must remain, however, but the claims of symmetric time dilation and remote non-simultaneity would have to go. 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, however; the GPS-LT 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.

References

[1]   A. Einstein, "Zur Elektrodynamik bewegter Körper," Ann. Physik **322 (10)**, 891 (1905).

[2]   T. E. Phipps, Jr., *Old Physics for New*, Apeiron, Montreal, 2006, p. 127.

[3]   J. D. Jackson, *Classical Electrodynamics*, John Wiley and Sons, New York, 1962, pp. 357-360.

[4]   J. C. Hafele and R. E. Keating, "Around-the-World Atomic Clocks: Predicted Relativistic Time Gains Science," Science **177**, 166 (1972).

[5]   H. J. Hay, J. P. Schiffer, T. E. Cranshaw and P. A. Egelstaff, "Measurement of the Gravitational Red Shift Using the Mössbauer Effect in Fe^{57}," Phys. Rev. Letters **4**, 165 (1960).

[6]   R. J. Buenker, *Relativity Contradictions Unveiled: Kinematics, Gravity and Light Refraction,* Apeiron, Montreal, 2014, p. 50.

[7]   C. M. Will, *Was Einstein Right?: Putting General Relativity to the Test.* 2nd ed. (Basic Books Inc; New York, 1993), p. 272.

[8]   T. Van Flandern, in: *Open Questions in Relativistic Physics*, ed. F. Selleri (Apeiron, Montreal, 1998), p. 81.

[9]   R. J. Buenker, "The global positioning system and the Lorentz transformation," Apeiron **15**, 254 (2008).

[10]   R. J. Buenker, "Simultaneity and the Constancy of the Speed of Light: Normalization of Space-time Vectors in the Lorentz Transformation," Apeiron **16,** 96 (2009)**.**

[11]   R. J. Buenker, *Relativity Contradictions Unveiled: Kinematics, Gravity and Light Refraction,* Apeiron, Montreal, 2014, pp. 55-56.

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