Brief History of Einstein's Flawed Version of Relativity Theory: How Phipps and Buenker Fixed It Over a Century Later

The following discussion covers the period from 1864 and the discovery of Maxwell's equations to the present time. The central event is the publication of Einstein's seminal paper on relativity theory in 1905.

Prehistory: Maxwell's major contribution to electromagnetic theory consisted of a series of mathematical expressions that proved to be consistent with all empirical results. Perhaps most interestingly, it indicated that the speed c of electromagnetic waves in free space is inversely proportional to the square root of the product of the electric permittivity ε_0 and the corresponding magnetic quantity μ_0 [$c= (\varepsilon_0 \mu_0)^{-0.5}$]. This result led to much discussion in the physics community about whether electromagnetic theory could be reconciled with the classical Galilean space-time transformation (GT). The above equation seemed to indicate that the speed of light emitted from a moving source is independent of the relative speed of the observer. This in turn was consistent with earlier observations of the Fresnel light-drag phenomenon. Moreover, subsequent experiments carried out by Michelson and Morley with an interferometer at different times of the year gave a null frequency shift that seemingly could not be explained on the basis of the classical transformation. Another key question stimulated by these experiments was whether there is a unique rest frame/aether for light similar to that known for sound waves. Numerous attempts were made to incorporate an aether into a general theoretical framework that was consistent with all observations, but none was successful in attaining a consensus among the leading physicists of that era. One conclusion that did find widespread favor was based on the

Galilean Relativity Principle (RP). It was argued that since the laws of physics must be the same in all inertial systems, it follows that the electromagnetic field equations must be invariant to a transformation of the space-time coordinates between any two rest frames. Several different transformations were reported that have this property. Indeed, Lorentz pointed out in 1899 that there is a degree of freedom in defining the transformation which is represented by a common normalization factor for its equations. This fact is easily understood by realizing that one condition for the new (relativistic) space-time transformation is that the speed of light be the same in different inertial systems, unlike the case for the GT. The normalization factor simply cancels out when the various spatial coordinates are divided respectively by the temporal coordinate in order to obtain the corresponding velocity.

Einstein's 1905 Theory: Einstein stepped into the fray in 1905 by making a simple conclusion: There is no such thing as an aether for electromagnetic waves. Instead, he formulated a general kinematic theory which is based on two succinct postulates. The first is a version of Galileo's RP, while the second states that the speed of light is independent of the states of motion of both the source and the observer. He then proceeded to derive what has come to be known as the Lorentz space-time transformation (LT), which satisfies the condition of light-speed constancy for any pair of inertial systems. *In so doing, Einstein made a fatal error.* He had to somehow eliminate the degree of freedom in the general Lorentz transformation mentioned above. He did this by claiming that the normalization factor in all four equations was only a function of the relative speed of the two inertial systems represented in the transformation. This was an assumption: a third (hidden) postulate of his new theory. He did not declare it as such, however. In fact, he didn't admit that it was an assumption at all. Instead, he went to great lengths to convince his audience that the LT was based uniquely on his two *declared* postulates.

The consequences of his undeclared assumption are stunning. They are claimed to overturn physical principles that were fully accepted at least since Newton's time. One of these goes back much further, namely that measurement is objective. Einstein denied this truism by claiming that a relativistic theory requires that two clocks in relative motion must each be running slower than the other at the same time. This is Einstein's Symmetry Principle (ESP). It was claimed to apply to all properties of moving objects: length, mass, energy, momentum etc. His hidden postulate also forces the conclusion that two events that are simultaneous for one observer are not simultaneous for someone who is moving relative to him. Einstein thereby refuted Newton's longstanding principle of absolute remote simultaneity of events (he received considerable backing for this assertion from Poincaré in 1904). He also claimed that space and time are not distinct but are inextricably mixed. The list goes on and on. After some time and much discussion, physicists started to fall in line with his radical conclusions based on the LT. The reason is that the same theory successfully predicts such key experimental results as the aberration of starlight at the zenith, the Fresnel light-drag phenomenon and the null result of the Michelson-Morley interferometer study. It simply went unnoticed that any of the infinite number of Lorentz transformations obtained by making a different assumption about the normalization condition gives exactly the same predictions; they actually derive from Einstein's velocity transformation (VT), which is completely independent of the choice of Lorentz's normalization factor.

More generally, physicists have lost sight of the basic principles of logical discourse. The first is that it is impossible to prove a theory on the basis of its successful predictions. The second is that it is eminently possible to disprove a theory by demonstrating that it leads to even one unequivocal contradiction. Proof by contradiction is one of the most effective tools in mathematics, but it is denied on a regular basis by physicists that are considered to be experts on Einstein's relativity theory.

The Transverse Doppler Effect: Experiments that test the LT predictions about space and time first began to appear in 1938 with the Ives-Stilwell transverse Doppler study. The title of their paper in J. Opt. Soc. Am. **28**, 215 (1938) is: "An Experimental Study of the Rate of a Moving Atomic Clock." The rates of clocks were not measured directly in their experiment, however. Instead, the displaced Doppler lines from canal rays were recorded on a glass plane grating. In short, wavelengths (λ) were measured directly and the corresponding frequencies (ν) were merely deduced from the equation for the phase velocity of light: $c = \lambda\nu$. While no one would argue with that assumption, it does lead to a clear contradiction to the predictions of the LT. The reason is because the measured wavelength shift is positive, indicating that the wavelength of the canal rays *increased* rather than decreased as would be expected on the basis of the Fitzgerald-Lorentz length contraction (FLC) derived from the LT. This is an example of "cherry-picking" in modern-day terminology. Advocates of Einstein's theory were jubilant to be able to say that the frequency of the canal rays had decreased because it meant that clock rates had indeed slowed down on the moving source, in agreement with the time-dilation predictions. Yet, none of the same authors pointed out that the increase in wavelength means just as surely that the lengths in the rest frame of the moving source have increased by the same fraction as clocks there have slowed down. This doesn't mean that these authors were unaware of the problem this increase in wavelength represented for Einstein's theory in general and the LT in particular. They argued instead that the increase in wavelength had nothing whatsoever to do with Einstein's predictions since radiation supposedly does not constitute matter and that it is therefore somehow outside the range of application for his theory, whereas the analogous argument was not made regarding the frequency of the radiation. This opinion of non-applicability for radiation is contradicted by the RP, however, since it demands that the diffraction grating and the observers themselves must have increased by the same fraction as the wavelength in the rest frame of the moving source. Otherwise, it is impossible to explain why the increase in wavelength is not detected at the light source. According to the FLC, the *in situ* wavelength observed *at the accelerated light source* must be greater by at least the same factor (or by its square in the parallel orientation) than the standard wavelength observed in the laboratory. In short, the Ives-Stilwell study was the first to contradict Einstein's predictions based on the FLC regarding length variations on a moving object. Yet, this fact went entirely unnoticed in 1938 and for many years to come.

The transverse Doppler study was followed closely thereafter by measurements of the lifetimes of accelerated muons. The pattern was exactly the same. The lifetimes were found to increase, in agreement with Einstein's time-dilation predictions, but they were also not measured directly in the experiment. Instead, it was the ranges of the meta-stable particles and they were found to be larger than normal, again indicating that a) the FLC is false and b) that the lengths of objects expand by the same fraction in all directions. Again, no mention was ever made in the accompanying papers of this state of affairs.

It was recognized that the above experiments could not say anything definitively about the ESP. "Two-way" experiments are required for this purpose and it was obviously impractical to measure wavelengths of canal rays generated in the laboratory from the standpoint of an observer moving with the accelerated light source. The same situation holds for the muon studies. The advent of Mössbauer spectroscopy presented an opportunity to change this situation. In 1960 Hay et al. mounted an x-ray source and detector on a high-speed rotor. They placed the detector/

absorber farther away from the rotor axis in order to simulate the case where the observer is moving faster in the laboratory than the light source. This experimental arrangement also guaranteed a perfectly transverse relationship between the source and the absorber, so the desired effect could be measured directly. The result was that a blue shift was recorded. The authors did not state this directly, however. The reader had to decipher this for himself by looking at the empirical formula given in the paper. Even that is difficult to do because the authors do not state clearly what is meant by the distances from the rotor axis denoted by R_1 and R_2, respectively, in the formula. Nonetheless, the fact that the frequency shift is inversely proportional to (R_1^2 - R_2^2) shows unequivocally that its sign changes with permutation of the positions of the source and absorber on the rotor. This anti-symmetric relationship by itself unequivocally demonstrates that the ESP is violated, in clear negative answer to the question that the experiment was designed to solve. One had to wait three more years before Kündig carried out the identical experiment and concluded that it is the accelerated clock that is slowed. That was the absorber clock in both his experiment and that of Hay et al., proving that an increase in frequency (blue shift) was observed in both cases. Yet, Hay et al. claim that the result of their rotor experiment can be obtained "using the time dilatation of special relativity." This statement is false. The most one can say is that the magnitude of the effect is in agreement with Einstein's theory of time dilation, but not the sign. Most probably in recognition of this state of affairs, Hay et al. come up with a second explanation in terms of Einstein's equivalence principle (EP). That explanation at least fits in with their empirical formula but the inherent asymmetry of the EP means that it can never be equated with the ESP of the LT, despite what Hay et al. claimed.

Sherwin's Interpretation and Dingle's Change of Heart: Shortly after the Hay et al. Note appeared in Physics Review Letters [Vol. 4, 165 (1960)], Sherwin moved to clarify the misrepresentation of their data [Phys. Rev. **120**, 17 (1960)]. He made the startling observation that Einstein actually had two theories of time dilation in his 1905 paper, one symmetric and one thoroughly asymmetric. Sherwin noted that many authors had already used the EP and the General Theory of Relativity (GTR) to predict the slowing down of clocks in moving systems, but he made the unsubstantiated claim that "time-dilation for clocks in uniform translation is an established fact." He went on to say: "When, however, this problem is analyzed in a reference frame attached to the traveling clock— and no theory of relative motion can be regarded as completely satisfactory unless it can describe the same experiment from the point of view of either of the two bodies which have the relative motion— the problem is far from simple." He goes on to make himself much clearer. "It is the completely unambiguous nature of the result in the 'clock paradox' experiment which is, perhaps, its most unique feature." A few lines later, he says: "The result is completely unambiguous: One particular clock certainly runs fast, and the other certainly runs slow. By contrast, in experiments involving uniform translation …the clock rates are ambiguous, that is, the observers in each frame measure the *other* clock to be running slow". The last part of that quote is simply claiming that the ESP would be observed if only the rotor experiment did not involve acceleration. This is the same thing as saying that the LT is not valid in this situation.

We should therefore believe that the asymmetry in clock rates observed in the Hay et al. study would be lost as soon as a state of pure translation occurred. Yet eight years later it is found from CERN experiments that accelerations of up to 10^{19} g do not contribute to the muon's time dilation. Only the relative speed of the muons to the laboratory determines the magnitude of the effect. Why would the observed asymmetry in clock rates suddenly change to perfect symmetry at the precise moment when the acceleration vanishes? Again, experiment is saying unequivocally that the LT has at best an extremely limited range of applicability. Outside that range, the ESP is not observed and there is no experimental evidence that it would be observed even if a perfect state of translation could be attained. The claim that GTR does correctly explain the results of the transverse Doppler experiments with rotors does not change this basic fact.

The above interpretation of the rotor experiments did not satisfy everyone in the physics community. Dingle was a key exception. He had been a prominent supporter of Einstein's theory and had written a widely read text discussing it. He was thoroughly convinced that the ESP represented physical reality and fearlessly predicted that this would be confirmed in two-way experiments such as the Hay et al. rotor study of the transverse Doppler effect. He took the strong position that the accelerated twin in the famous clock paradox would age at exactly the same rate as his stay-at-home brother no matter how great their relative speed might become during the course of the flight. It's safe to say that he was shocked by the actual results of the rotor experiment. Unlike Hay et al. themselves, he concluded that their results violated the ESP and thus unequivocally contradicted Einstein's theory. He changed his mind about the twin paradox and began to entertain the idea in public that the traveling twin would return at a much younger age than the other twin.

This turn of events represented a key turning point in the history of relativity. The reason is certainly not because a learned scientist had suddenly changed his mind about a previously untested proposition. That can happen anytime assumptions are made that have no basis in fact. The real excitement was felt in the editorial rooms of the great scientific journals of the time. The authorities were highly embarrassed by Dingle's 180-degree turn. Rather than carefully consider the reasons for his conversion away from the ESP and related predictions of Einstein's theory, they came to an unbending determination that something like this should never be allowed to happen again. The effect on mainstream journals was nothing less than spectacular. From that time on, it was absolutely impossible to have articles that were critical of the orthodox relativity theory to be even sent out to referees for the evaluation of acknowledged experts, much less to be published at all. Gatekeepers were posted at the top journals to enforce this embargo. Oftentimes, they punctuated their refusal to consider such "heretical" manuscripts with downright insulting comments that bear no relation to the ideal of scientific objectivity. At the same time, well-known experts in the field bragged about how many manuscripts of this type they received on a regular basis that were quickly filed in the nearest waste basket.

The Hafele-Keating Circumnavigation Tests of Atomic Clocks and their Application to the Global Positioning System: The development of stable atomic clocks made it possible to make direct tests of time dilation that would at least complement the results of the transverse Doppler and muon studies. In 1971 Hafele and Keating placed clocks on commercial aircraft circling the globe in easterly and westerly directions respectively. The timing results were then compared with those obtained with clocks left behind at the origin of the flights. In the introduction of the paper describing their empirical findings these authors pointed out that opinions among physicists of the time were considerably divided over the expected outcome of their experiment, demonstrating that the predictions of Einstein's special theory of relativity (STR) were far from being unambiguous even ten years after the rotor studies of Hay et al. had been reported. Hafele and Keating were able to estimate their results to an accuracy of 10%. Once again it was perfectly clear that the ESP had been violated in their experiment, just as it had in every one before it that had a chance of confirming it. The clock heading in the easterly direction was slowest, followed by the one at the airport, which in turn was slower than the westbound clock.

This result could be explained in a similar manner as the rotor data. The key was to determine how fast a given clock was moving relative to a hypothetical reference clock that was stationary at the "non-rotating" polar axis of the earth. The latter rest frame played the same role as the rotor axis in the Hay et al. transverse Doppler study. In agreement with Sherwin's interpretation in the latter case, Hafele-Keating concluded that the non-rotating polar axis was special because it played the role of a unique inertial system in their experiment. One only need know the speed v of a given clock relative to this reference and then assume that its rate was proportional to γ (v) = $(1 - v^2c^{-2})^{-0.5}$. The eastward-moving clock moved faster relative to the hypothetical clock than the one traveling in the westerly direction and the stationary clock at the airport had an intermediate speed between these two values. This is exactly the same procedure used by Einstein in 1905 to predict the slowing down of clocks at the Equator relative to those at the Poles. So why was there so much uncertainty in predicting this result? Because the asymmetric result of their measurements is incomprehensible if one assumes the process is governed by the LT.

It was necessary to consider a second effect to obtain quantitative agreement with experiment. There was also a gravitational effect on the clocks, and this agreed quantitatively with Einstein's prediction of the gravitational red shift in a 1907 paper. This showed that the latter is quite distinct from the effect expected from Einstein's EP that was used to explain the time dilation in the rotor study and also the east-west difference in clock rates in the present experiment. What is clear empirically is that there are two effects, one depending exclusively on the state of motion of the clock relative to the above reference and the other depending exclusively on its position in the gravitational field of the earth. Each of the two effects can be observed without the other. Two clocks at rest at different altitudes can be compared or two clocks moving at the same gravitational potential can be compared. Hafele-Keating showed that the two effects are both independent and additive.

The situation seems quite neatly explained in their analysis *until* one begins to question the role of the non-rotating polar axis. The earth's center of mass is not inertial because it is constantly changing its speed as it makes its way around the sun. People sitting at the airport or on airplanes traveling at cruising speed over the earth's surface are not aware of any forces acting upon them, so why the critical distinction in choosing a reference system for determining the relative speeds that appear in the γ proportionality factors? Why not at least admit the most significant theoretical result of the airplane study as well as of the transverse Doppler experiments, which is clearly that the ESP, and the LT on which it is based, is completely contradicted by these empirical findings?

None of the above discussion should conceal the very positive aspects of the Hafele-Keating study. It led to physical laws that can be extremely useful in future investigations. These laws are on a par with Newton's Laws of Kinematics and Universal Gravitation. Newton didn't attempt to explain the laws, just to promulgate them in an optimally clear fashion so they could be intelligently applied in future investigations. Something analogous is actually what transpired in the design of the Global Positioning System (GPS). It was clear that distances between satellites and the earth's surface could be measured to high accuracy if the elapsed times required for light pulses to travel between them were known to high accuracy. To accomplish this objective it is necessary to know that the local clocks in the two rest frames do not run at the same rate. The Hafele-Keating laws allow for an adjustment of clock rates on the satellite to bring them in coincidence with those on the earth's surface so that differences in clock readings in the two rest frames can be obtained in the same units. The result of these considerations has had a revolutionary impact on the everyday lives of the general populace, but this only became possible by ignoring the predictions of the ESP and the LT, and relying instead on empirical findings obtained from careful experimental studies.

Phipps's Alternative View to Einstein's Relativity Theory (2006):

There followed a period of some 40 years of discontent and frustration with the orthodox version of Einstein's theory. The inability of authors to get their papers published in mainstream journals and books led to the establishment of new journals that were open to fresh ideas of how to correct this state of affairs. One of these was Apeiron published by Roy Keys in Montreal. In 2006 a book was published from one of its most frequent contributors, T. E. Phipps, Jr., entitled "Old Physics for New." It began with a critical evaluation of Maxwell's equations, which has become the prototype of all field theories. It pointed out that these equations represent "mathematical idealizations parading as physical descriptions." They were put forward "tentatively by one generation, promoted into the next generation's eternal truth." Phipps emphasized that Maxwell's field equations "are not invariant under first-order (Galilean) inertial transformations." Maxwell had predicted fringe shifts that this lack of invariance implies, but none had ever been found. This did not concern Maxwell because he "thought of the electromagnetic description as subject to simplification in a fundamental system of ether 'at rest.' Maxwell had predicted fringe shifts that this lack of invariance implies, but none had ever been found. Lorentz and many contemporaries felt that Maxwell's equations were nonetheless correct and argued instead that the Galilean transformation itself was responsible for the false predictions. Ultimately, Phipps argues instead for a Hertzian form of Faraday's law, even though that would destroy the "spacetime symmetry" of the LT (see p. 13). He noted that resistance to doing this is very high because reputations of modern-day physicists would be tarnished as a result.

It is beyond the scope of the present discussion to go into many details of the Phipps critique, but a few key examples suffice. He notes on p. 39 that the travel-time discrepancy associated with the Sagnac effect in all inertial systems suggests that a rider on the platform has to attribute different speeds of light in the two directions of the interfering light beams. This caused Einstein himself to write that "vacuum light is propagated with the velocity c, at least with respect to a definite inertial system." In other words, light-speed postulate is not absolute when acceleration is involved. This observation is relevant to the practice in GPS of using speed c+v and c-v to obtain the range the light travels on the way from the satellite to the earth.

Probably the most enlightening discussion in the book concerns the twin paradox. Phipps considers an example in which the laboratory observer sees two groups of muons to be "staying young equally." Yet, observers traveling with the two sets of muons must each find it is the other set that is staying younger. One might refer to this as the "triplet paradox." He then writes: "Thus the paradoxes of two observers are compounded into the contradictions of three observers." The experimental adjustment of GPS clocks to ensure that they run at the same rate in orbit as on the ground demonstrates that the above argument is verified by experiment. "There is an objectively real asymmetry– otherwise the compensation would not work." He later uses the clock rate adjustment to show that two events that are simultaneous for an observer on the satellite must also be simultaneous for his counterpart on the ground. That straightforward result is just another proof that the LT is contradicted by actual experience.

Buenker's Clock Riddle and GPSLT: One can summarize the above history quite succinctly. Physicists are adverse to addressing criticism of Einstein's STR because of the central role it plays in modern field theory. On the other hand, there have been numerous logical arguments brought over at least the last 50 years that show that various aspects of STR are self-contradictory. One is reminded of Newton's remark which he used to justify his attempts to modify the physical theories of his day. He said that classical philosophers such as Aristotle and Plato were his friends, but his greatest friend was the truth. That attitude to reforming scientific thought might seem corny and over-the-top in today's sophisticated publishing world, but it is based on a perfectly legitimate desire to arrive at an error-free understanding of nature's most fundamental processes. The principles of logic trump traditional beliefs when they do not coincide, and so one should have faith that any success in removing contradictions from current thinking will have long-term benefits that far outweigh the short-term advantages of suppressing well-founded dissent.

After many unsuccessful attempts to have his ideas on relativity published in mainstream journals, Buenker began to send his work to Apeiron in 2008. One of the first papers was a computational study of Schiff's 1960 treatment of the displacement of star images during solar eclipses. Schiff assumed certain scaling relationships for space and time that Einstein had introduced in his 1907 paper on the EP. Einstein had tried a similar approach earlier but had underestimated the angle of displacement by a factor of two. Schiff altered the scaling procedure and obtained the correct value using Huygens' principle (the same as Einstein had used), but in so doing he assumed that light travels *in a perfectly straight path* even in the neighborhood of strong gravitational fields (wave fronts are rotated, not light rays). By scaling radial velocities differently than transverse components, he arrived at exactly the same result as Einstein had obtained in 1916 using his general theory of relativity (GTR) and the concept of curved space-time. Quite surprisingly in modern terms, he was able to issue a challenge *in print* on this basis to experts in GTR. He suggested that perhaps the far simpler theoretical approach he had used to compute the displacement angle might have more general applicability, thereby at least implicitly questioning the need for the much more complex procedures required in applying GTR to the same phenomena. Schiff pointed out that there are really only three gravitational effects that have been successfully treated by GTR: the red shift, the above image-displacement angle and the angle of precession of Mercury's perihelion. He had to admit that he did not see at that time how he could compute the latter angle with his method, however, but he felt that the gravitational red shift was something that also did not require GTR. Buenker's contribution 48 years later was to scale the acceleration due to gravity g in Newton's classical theory in a manner that was consistent with Schiff's own scaling of velocity components. He obtained Einstein's value for this angle, which also agrees very well with the observed result. The attempt to publish this extension of Schiff's method in the original journal was rebuffed by the editor; his referee rejected the idea on the grounds that it was *ad hoc*, clearly not recognizing that both GTR and STR are also *ad hoc*. The paper was successfully published in Apeiron.

What is most significant about the simplified procedures used above is their implied assumption that measurement is perfectly *objective*. Schiff had assumed that observers at different gravitational potentials obtain different values for the same quantities simply because they use different sets of rational units in which to express their respective results. The obvious question is why the same assumption of strict objectivity would not also hold for STR. The answer of course is that the ESP is incompatible with such an assumption. It is impossible to assign units to the rest frames of different observers when they can't agree whose clock is running slower or whose meter stick is shorter. The LT guarantees that the measurement process is subjective in STR, which makes it impossible to devise conversion factors between the units of different observers when they are in relative motion to one another.

This fact led Buenker to examine Einstein's 1905 derivation of the LT in order to understand where this inherently subjective characteristic comes from, which in turn led him back to Lorentz's observation (as already mentioned) that there is a degree of freedom in choosing a space-time transformation that leaves Maxwell equations invariant. The conclusion was that aspects of STR such as the LT, the ESP, the rejection of absolute remote simultaneity, and especially the concept of space-time mixing that is so esteemed by experts in relativistic field theory, all hinge on Einstein's undeclared assumption about Lorentz's normalization function. A key consideration was the fact that any choice of this parameter leads to the same velocity transformation (VT) as Einstein found based on the LT. All of the space-time predictions of STR that have ever been verified experimentally result directly from the VT and thus do not require use of the LT in any way. This observation raises two distinct questions: a) can one choose a different value of the normalization factor that is based on hard experimental evidence? and b) can one prove by other means than experiment that Einstein's choice is unacceptable?

The latter objective is easily fulfilled by considering the existing arguments that have already been raised against the ESP. Following the symmetric time dilation to its logical conclusion means that clocks at the same location must be running at ever slower rates *at the same time* depending on how often the back-and-forth comparison is made with clocks in the other rest frame. Also as discussed above, the strict proportionality factor for the rates of clocks in different rest frames also rules out any possibility of remote non-simultaneity. This point was also emphasized in another 2008 paper by Buenker. A few years later he introduced the "clock riddle," whereby two observers in motion measure the length of a metal rod oriented perpendicularly to their direction of motion. According to the FLC, there must be complete agreement as to the value of this length. There is another way to measure it, however, namely to let a light pulse pass between its two endpoints. The speed of light is the same for both in all directions because of Einstein's second postulate, while the respective elapsed times must be different because of time dilation. The conclusion using this method is therefore that the two observers will disagree as to the rod's length, in direct contradiction to the aforementioned conclusion based on the FLC.

The clock riddle has more significance than just leading to another inconsistency in STR, however. After all, it only takes one contradiction to disprove a theory. What it shows in addition is that Einstein's second postulate implies that lengths *expand* on moving objects at the same time that its stationary clocks slow down. That is isotropic length expansion, not the asymmetric length contraction expected from the FLC. As already mentioned, the transverse Doppler experiments proved that the wavelength of light increases on an accelerated light source while the corresponding frequency decreases, in unequivocal agreement with the above theoretical result. That conclusion should have been obvious from the fact that the speed of light in free space is always equal to the product of frequency and wave length, but this condition was simply overlooked by physicists in the context of the Ives-Stilwell experiment because no one dared to point out that this result actually contradicted the FLC.

Question a) above is easily answered as well. The key experimental evidence needed to fix the value of the Lorentz normalization factor is provided by the time-dilation experiments: clock rates in different inertial systems run in fixed proportion: $\Delta t' = \Delta t/Q$. The proportionality factor Q is easily computed on the basis of the relative speeds of the two inertial frames to a particular reference (objective rest system, ORS) such as the rotor axis in the Hay et al. experiment or the earth's center of mass in the Hafele-Keating study of atomic clock rates. This corresponds to asymmetric time dilation, not the ESP. The ORS concept also has a bearing on the relativistic theory of electromagnetic interactions. It means that the electron velocity in the Lorentz Force has a specific reference as well, namely the origin of the electromagnetic field, and this is the same for all observers regardless of their state of motion. This allows for a much different interpretation of the RP than was assumed by Lorentz and his contemporaries. It simply demands that the results of identical experiments for which the ORS is stationary in a *different* inertial system at a different point in time must be the same in all cases. This far less restrictive interpretation of the RP makes it unnecessary to assume that the pertinent electromagnetic equations are invariant to any specific space-time transformation. The essential criterion is therefore that the equations are able to successfully predict the results of electromagnetic interactions for field strengths of arbitrary magnitude independent of the state of motion of the laboratory in which they occur. In addition, one has to assume that Einstein's light speed postulate holds so that Maxwell's $c = (\varepsilon_0 \mu_0)^{-0.5}$ relation is satisfied in each case. This interpretation of the RP is clearly in line with Phipps's assertion that the Hertzian version of electromagnetic interactions also gives accurate predictions of these phenomena on a quite general basis.

The Lorentz normalization factor can be chosen to satisfy the above proportionality condition for elapsed times in the two inertial systems. Alternatively, one can just meld the proportionality equation with the three VT equations and obtain the same result. This has been named the Alternative Lorentz Transformation (ALT) or, more descriptively, the Global Positioning System Lorentz Transformation (GPSLT). It obviously satisfies Einstein's two postulates of relativity but it eliminates all the contradictions noted above for the LT. The problem for field theoreticians is that the strict proportionality of clock rates is not compatible with their view that space and time are inextricably mixed and that they are just four different quantities of a more general property known as spacetime.

The GPSLT also has other more positive characteristics, however. Unlike the LT, it conforms to a perfective objective view of the universe. No longer is it necessary to teach aspiring young physicists that two clocks in motion must each be running slower than each other. The revised theory also meshes seamlessly with Schiff's gravitational theory. There is a different proportionality constant (S) in this case. It is easily computed on the basis of the positions of the two observers in a gravitational field. The conversion factors between the different rational systems of units are integral powers of Q and S as given in another of Buenker's papers published in 2008. These powers have been determined on the basis of experiment and qualitative considerations based on the EP in some cases. One consequence of the latter development is nonetheless to show that the EP is an imperfect physical principle. The reason is because the speed of light changes with gravitational potential. Use of the EP to explain the results of the rotor experiment appears to be satisfactory only until this point is realized. The speed of light at the source is the same as at the absorber in the Hay et al. experiment, whereas the EP demands that it be greater in the rest frame of the faster clock. The GPSLT does not have this deficiency since it demands that the speed of light be the same at both locations even though the respective clock rates differ.

Epilogue: The above discussion shows first and foremost that there are many aspects of Einstein's relativity theory that do not conform to the most basic principles of logical discourse. The claim that any of these inconsistencies is in any way essential for the description of experimental phenomena is shown to be false. The problems with Einstein's theory are easily fixed by insisting instead on the ancient precepts of objectivity and remote simultaneity that Newton promulgated in his work over 200 years ago. Newton simply did not anticipate that the speed of light is the same for all observers regardless of their state of motion and that of the light source. That is the main reason why the classical theory is not able to explain the revolutionary experimental findings that started to emerge in the latter half of the 19th century. One of the most positive aspects of Einstein's theory is that it led to new experiments that also had a profound effect on our understanding of basic physical principles. Specifically, they showed that the properties of objects change with their state of motion and position in a gravitational field. The present history does not attempt to explain why this is so. Rather, the results are used to formulate new laws of physics that are both internally consistent and conform to all previous experience, just as do Newton's Laws of Kinematics, Galileo's RP and the Laws of Thermodynamics that were introduced long before.

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