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The Light Sphere Paradox Of Special Relatively

By Harry H. Ricker III
Email: kc3mx@yahoo.com

1.0 Introduction

This paper studies the light sphere paradox of Einstein's special theory of relativity and demonstrates that the failure to establish a correct mathematical analysis of this problem has allowed a major flaw in that theory to be turned into the foundational mathematical basis of that theory, which is unfortunately false and erroneous.

2.0 Background

Unlike the much more famous paradox of the twins, the light sphere paradox is relatively unknown. It has not produced the volume of critical discussion or commanded the attention of critics of relativity that it deserves. The author could find only one reference to this paradox in an Internet search and only four references to it in his collection of relativity books.

2.1 Description Of Paradox Of The Spheres

The best introductory discussion of the paradox is presented in Basic Concepts of Relativity, by R. H. Good, pages 39 and 40. Good asks the reader "Suppose a light pulse emitted from a stationary source at the origin at time t=0. It then spreads out with velocity c in a spherical wave front, as seen by an observer at rest relative to the source...Now an observer in another frame of reference moving uniformly in the x direction with velocity v relative to the first frame will also see a spherical wave front spreading out with the velocity c from the origin of his reference frame, assuming that the origins coincide at t=0. This is not what one would expect intuitively; one would expect the sphere of light to remain centered on the source, and consequently to move with different velocities in different directions away from the origin, as seen by the observer in the moving frame."

A more puzzling description is given by H. Muirhead in The Special Theory Of Relativity, page 17. Muirhead says "Let us examine what the observers record in the frames Σ and Σ' in more detail. The observer stationed in Σ (in which the the light source at O is at rest) sees the wave front of the light source from O spreading as a sphere and at any moment in time t, the positions in the wave front are located by the relation $x^2+y^2+z^2=(ct)^2$ or $x^2+y^2+z^2-(ct)^2=0$. The observer located in Σ' would also see the light spreading from O' as a sphere....These two relations can only be satisfied if the two observers see *different* spheres. We illustrate this point schematically in figure 2.2, where the light spreads from sources O and O'." This statement is followed by a drawing in which two the *different* coordinate systems are shown displaced relative to each other with two different circles drawn with respect to the two different origins. Thus two different displaced or translated circles are shown. The reader is left to contemplate this mystery as the author proceeds to derive the Lorentz transformations based on this illogical mystery, which his version of the theory has presented, but never resolves. Hence the paradox is avoided in the authors mind, but the reader is left stupefied.

An elegant solution to the paradoxical difficulties is apparently achieved by Donald H. Menzel in his book Mathematical Physics, pages 376 and 377. Menzel prepares the ground by telling the reader that "Einstein pointed the way out of the dilemma." Menzel describes the problem basically in the same way as does Muirhead, but he adds, "It seems paradoxical even to suggest that the form of the wave front as viewed from S' could be considered by that observer as a sphere *centered* at S'. But that is exactly what the relativity postulate requires. The velocity of light, as measured in either system must be a constant. There is no essential difference between S and S' since both are inertial systems. Thus figure 1b presents the reciprocal conditions from the viewpoint of observer S'." Figure 1b is drawn as two separated circles, with separated origins S and S', which are moving in opposite directions. Menzel continues: "Certainly we cannot possibly satisfy (5) and (6), which imply the existence of one sphere with two different centers, if we retain Euclidean ideas of measurement. We have already seen, however, that the the classical concept of simultaneity and therefore of a universal time system runs into difficulties. Perhaps spatial conditions are similarly altered..." He then proceeds to derive the Lorentz transformations without further explanation of their intended meaning.

In his book, Good gives basically the same answer to the paradox as Menzel, "But it follows from Einstein's second postulate that the light must spread out with velocity v in all directions, in any reference frame, regardless of the motion of the source. Each observer finds that his origin remains at the center of the expanding sphere of light for as long as he continues in uniform motion. And of course each observer finds that the others origin is not at the center. Their disagreement on this point stems from the usual relativistic effects: the Lorentz contraction, time dilation and relativity of simultaneity."

2.2 Standard Resolution Of Paradox

This section discusses the standard resolution of the paradox of the spheres. In this interpretation, there is no actual paradox to be resolved, because the paradox is an artifact of the correct understanding of the problem. The source for this discussion is taken from a book by Richard Schlegel, Superposition and Interaction, University Of Chicago Press, 1980, pages 82-85. In Figure Ten two different spheres, that is ones which have different centers of expansion, are shown as in the previous three examples of section 2.1. In the figure, the center of each of the two different spheres are shown as being at the origins O and O' for the two relatively moving reference frames. Whereas, all of the previous authors attributed the resolution of the paradox to relativistic effects in a vague way, Schlegel tells us very specifically how the paradox is resolved: "The application we have made of the Lorentz transformation is to the clocks and rods of systems S and S'. In consequence of their motion relative to each other, they take the specified transformed values. It is important to note that the alterations are purely relational: It is with respect to the x,t (rods and clocks) of one system that the x',t' (rods and clocks) of another system have the altered values."

He goes on to explain further Figure Ten as follows: "Also, we note that in the spreading-wave illustration as we have presented it there is no postulated physical alteration of the wave front. Rather, it is taken that we have a single, unaltered electromagnetic signal (depicted as a spherically expanding wave. Observers in relatively moving systems S and S' each find the signal to move with speed c because of the relative changes (Lorentz transformations) which their clocks and rods undergo: the invariance is not a consequence, on this view, of any changes in the electromagnetic wave. But because of the different specifications of simultaneity, the wave front occupies a different set of space points in S, at time t, than it does in S', at time t'." The defect with this resolution should be obvious. After telling the reader that the Lorentz transformations change the way the observer sees the single sphere as two different spheres, the author compounds the difficulties by giving a different resolution that involves the relativity of simultaneity and changes in time and space. In the first explanation are are supposed to believe that there are two different spheres and in the second that there is only one single sphere.

To gain a clearer understanding of the difficulty with the standard resolution consider what W. Pauli says in Theory Of Relativity, Dover Publications, 1958, page 9. "At first sight it appears as if the two postulates were incompatible. For, let us take a light source L which moves relative to an observer A with velocity v, and consider a second observer B, at rest with respect to L. Both observers must then see as wave fronts spheres whose centers are at rest relative to A and B respectively. In other words they see different spheres." This is perplexing since it must be clear that in order to resolve the paradox in the manner proposed, that each observer sees only one sphere and is totally unaware that the sphere looks different to a relatively moving observer. The disagreement only arising when the tow of them disagree over where the light source L was located. Was it in S or S'.

To put it as clearly as possible, in order to resolve the paradox the two different observers must be persuaded that the spheres are simultaneously the same and different from what they seem to be from observational instruments and rules of procedure. That is the paradox is really to be stated this way. The same sphere is seen to be two different spheres by different observers and the two different observers see two different spheres, that are the same sphere. The spheres are both same and different, simultaneously. So the observers can not agree on the physical reality of what they see. According to the theory of relativity, they must disagree, and this inevitable disagreement can never be resolved. So there is and always will be a paradoxical situation that is unresolvable, that is a fundamental law of nature according to the principle of relativity.

2.3 Critical Definition Of Paradox -The problem

In this section the definition of the light spheres paradox problem will be described. To understand the difficulty, the problem will be divided into two parts. These two parts reflect the two different aspects of the paradox, although the second aspect is not generally discussed as a paradox. However, before doing that, it is important that we deal with the problem we left in the last section. That is the problem of how a physical phenomena can be both same and different. That is do we have two spheres? Or only one sphere? Do we have one single physical reality viewed differently, that is the expanding sphere created at the origin of frame S, or do we have two different spheres created at the origins of S and S'? Do we have an expanding light sphere that in frame S seems to have its source in S, or is the source in S', since the observer there sees it as expanding from his origin O'? Relativity gives us the answer that all of these are the same physical reality, but the facts of observation can only tell us that there is no physical reality that can be determined from experiment, since all of the observational facts lead to contradictions. If the reader doesn't agree that this is an unsatisfactory situation for a science of nature, then he probably should read no further.

2.3.1 Causality Paradox

The main paradox is as follows. That is if a single event, resulting in a casual physical process, is described as occurring in one of the frames, called the rest or stationary frame, then it is impossible to understand how a coordinate transformation of the physical problem, called a Lorentz transformation, is sufficient to describe an observationally equivalent physical situation in a different reference frame, the moving frame. This moving frame being a coordinate reference frame that is in motion relative to the first reference frame. This is the same as saying that two different observers experience two different physical processes resulting from the same cause. Put differently, in relativity physics, the mathematical descriptions of physical processes are not unique.

This is usual way in which the paradox is understood. It follows from the fact that if the event is to be described with respect to two different physical reference frames, then how is it possible for the same mathematical description to be used for the two different frames? Put differently, the assertion is that the same physical process is described identically in two different coordinate systems of reference. The question then becomes, how is this possible, if the coordinate systems are supposed to be different, that they produce the same mathematical description of the physical process? From this it must be concluded that mathematical description of physical process is not unique.

The second problem is a restatement of the first difficulty. It is, if the two mathematical descriptions of the same physical process are identical, the usual relativistic description is invariant, then how is it possible to derive equations of transformation that are different from the identity transformation? Put differently, this second paradox arises as a result of the answer that is given to the first paradox. While the first paradox is usually answered, the question that arises from that answer in the form of the second paradox is never addressed. Perhaps another way to state this problem is to ask, are the two apparently different descriptions really describing different things in the same way or simply the same thing, which is supposed to be different in frames S and S', but isn't?

2.3.2 The Principle of Relativity Problem

The fundamental claim that Einstein makes is that the light speed postulate is not incompatible with the relativity postulate. The light sphere paradox is a particularly good illustration of the paradoxical difficulty involved in that claim. This obvious solution to the paradox is the following. That is we consider that the velocity of light has a constant component relative to the moving frame caused by the velocity of this frame with respect to the stationary frame. Thus we could solve the problem is this manner. That is the velocity of light in the moving frame has a constant velocity added to it by the relative motion of the frames. All we have to do is apply a Galilean transformation of velocity. But that solution is in violation of Maxwell's equations. But it is obvious from the statement of the problem and the drawings given that illustrate it, that this is exactly what is happening. Hence we should state the paradox rigorously as follows: According to Maxwell's equations there should be one and only one, that is a unique, rest frame in which the velocity of light is a constant. According to this principle, there should be one and only one rest frame wherein the light pulse expands as a sphere. In the moving frame the light velocity must not be constant. This contradicts the light velocity constancy postulate. If we accept the light constancy postulate of Einstein.

2.3.3 Group Property and Empirical Paradox Problems

There are two major reasons why this writer and other critics believe that the Lorentz transformation procedure established by the special theory of relativity is false. The first one is the well established fact that the Lorentz transformations fail to demonstrate the group property despite the fact that it is supposed to exist. This failure to possess the required group property, that is the requirement that the inverse Lorentz transformation is the mathematical inverse of the Lorentz transformation, results in the many paradoxes of relativity. The twins and clock paradoxes being the most well known and recalcitrant.

The second reason is the empirical evidence refuting relativity. Here the empirical evidence that refutes relativity can be understood best within the context of this discussion of the paradox of the spheres. The discrepancy relates to the well established fact of stellar aberration which can be seen to contradict the special theory by thinking about the expanding spheres problem. The conclusion of the analysis discussed in detail in sections 2.1 and 2.2 is that the motion of the observer has no bearing at all upon the shape of the wavefront that he observes. That is that irregardless of the observers state of relative motion, he always sees the same isotropic wavefront with expanding center in his rest frame. The source is always in the same place, whether the observer is in the S frame or the S' frame moving relative to S. But we know from the measurements of stellar aberration, that the apparent position of a star, that is what the observer sees, changes with the state of motion of the earth. In other words, it does matter which frame, and state of motion, the observer is in, and so his state of motion is a critical factor in determining the apparent position of the star. This is a decisive empirical contradiction of the claims of the theory of relativity given in sections 2.1 and 2.2. Hence the claims of relativity that supports the interpretation given in these sections above, must be false.

Another problem with empirical confirmation arises directly in the context of the paradox of the spheres. An examination of a paper by Harry M. Schey, Expanding Wavefronts In Special relativity: A Computer-Generated Film, American Journal Of Physics, Volume 37, Number 6, May 1969, page 514, presents two contradictions. The first one is that Schey's calculations show that the expanding wavefront in S is not a sphere, but a prolate ellipsoid with the x axis contracted so that it is prolate in the y and z axes. The second contradiction is that the interpretation presented by Schey contradicts the empirical evidence from experiment that the wavefront in the moving frame is a prolate ellipsoid with the long axis in the direction of motion. For this empirical evidence see, Herbert Ives, Interference Phenomena With A Moving Medium, Journal Of The Optical Society Of America, Volume 1, January 1941, page 14, Figure 5.

3.0 Objectives

The fundamental claim presented in this paper is that the Lorentz transformation equations are based upon a mathematical error, or more precisely, that the method of proof used to demonstrate the compatibility of the two postulates of relativity, which is manifested in the paradox of the spheres, is based upon a mathematical mistake, that fails to take into account the correct procedure for handling affine transformations. This claim amounts to stating that the procedure used to prove the theory of relativity lacks mathematical rigor, and when correct and proper rigor is applied, the paradox of the spheres will eliminated and the correct interpretation of the Lorentz transformations will be identified.

The accomplishment of the primary objective will be achieved through the demonstration of the following theses. The first thesis is that the operation of Lorentz transformation is mathematically incorrect because these transformations don't form a group of affine transformations as claimed by relativity textbooks. The second thesis is that in the theory of Lorentz transformations, the operation of transformation of coordinates from a rest frame S into a moving frame S' does not involve frames of reference that are actually in relative motion. The third thesis is that the theory of Lorentz transformation fails to take into consideration the problem of alibi and alias transformations.

The final objective will be to demonstrate the correct mathematical procedure that resolves the paradox of the spheres. The paradox is thereby shown to be an incorrect result of an erroneous mathematical procedure combined with the incorrect postulates of relativity. The result shows that the relativity postulate is not verified, and therefore must be rejected.

4.0 Method and Approach To the Problem

As stated in section 3.0, the objective is to demonstrate the rigorously correct mathematical solution to the problem of the transformation of expanding wavefronts. The steps required in accomplishing this task, is first to convince the reader that the standard method used in the special relativity theory is false. The method will be to use a standard derivation of the Lorentz transformation and show how that works, and then following on it will be shown that the Lorentz transformations lead to a contradiction. That is that the transformations are not correct and proper inverses.

The next step will be to start from the beginning and derive the affine transformation of the expanding wavefront in S by transforming it into the moving frame S'. This procedure will employ the alibi and alias transformation concept. The result shows that it is not possible to correctly transform from an expanding wavefront in S, into an expanding wavefront in S'.

In the last step, the correct transformation method will be demonstrated wherein the interpretation of the Lorentz transformations will be given a more rigorous foundation. This will take into consideration transformation of coordinates from the alias and alibi transformation viewpoints. This approach will be used to prove that the Lorentz transformations are false.

The conclusion of the last step is that the operations of Lorentz transformation that renders invariant the wavefront in frames S and S' is mathematically invalid. Finally, the correct transformations to be used will be presented and discussed.

5.0 Mathematical Analysis

5.1 The Traditional Textbook Method

In this section the problem of the light spheres will be discussed from the traditional relativity textbook viewpoint. This will be followed by a proof wherein it will be shown that that traditional viewpoint is untenable because the mathematics shows that no motion of the reference frames is involved. The light spheres problem involves the solution of the following equation:

(1) $$x^2+y^2+z^2-(ct)^2=x'^2+y'^2+z'^2-(ct')^2=0$$

The meaning of this equation was made obscure by the introduction by Minkowski of his space-time conception. However Einstein, to his credit, didn't use this obscure Minkowski equation, but used two separate equations as follows: (1a) $x^2+y^2+z^2=(ct)^2$ and (1b) $x'^2+y'^2+z'^2=(ct')^2$ These equations first appeared in Einstein's 1905 paper. For Einstein, the purpose of the equations in 1 was to prove that the postulates of relativity are consistent with the Lorentz transformation of coordinates that Einstein deduces from the redefinition of time. The modern method proceeds differently by obtaining solutions to the two equations in 1 so that they are equivalent. The procedure is very well known and it will not be repeated here. Hence we will skip this and proceed to the proof that the Lorentz transformations form a group. This procedure is a standard one, but the steps will be given here in order to point out some aspects of the method. (The reader is referred to A.P. French, Special Relativity, page 81 for details.)

Take equation 1a and substitute the following inverse Lorentz transformation of coordinates:

(2) $x=\beta(x'+vt')$ and $t=\beta(t'+vx/c^2)$, $y=y'$, $z=z'$

We obtain:

(3) $\beta^2(x'+vt)^2+y'^2+z'^2= \beta^2 c^2(t'+vx'/c^2)^2$

Which expands as:

(4) $\beta^2 (x'^2+2vx't'+v^2 t'^2)+y'^2+z'^2=\beta^2 c^2(t'^2 +2vx't'/c^2+v^2 x'^2/c^4)$

In the standard method, the "cross terms" 2vx't' are subtracted from both sides. Then the terms are rearranged by moving the $v^2t'^2$ from the left side to the right side, and moving the $v^2 x'^2/c^4$ term from the right side to the left side so that now we have collected terms in t' on the right and x' on the left we obtain:

(5) $\beta^2x'^2(1-v^2/c^2)+y'^2+z'^2= \beta^2c^2t'^2(1-v^2/c^2)$,

which reduces to the desired result because we realize that the term $(1-v^2/c^2)$ is equal to $1/\beta^2$ and so their product is equal to unity. The result obtained by these manipulations is equation 1b. But it is suspect that this procedure of reducing 1a to 1b through the substitution of 2 is a valid one for the following reasons. The procedure doesn't move the zero reference of the reference frame from S into S' at all, because there is no change in zero reference operation in the procedure. The procedure only uses a change in coordinates by a scalar multiplication equivalent to a dilation. That is the only change in coordinates operation is the fortuitous dilation by the factor beta which luckily cancels out by magic, which presents the illusion to the unawares that the transformation of coordinates has moved the origin of the expanding wavefront from S' into S. But no actual change in zero reference was employed in the procedure, and so it must be a false procedure. Further, there is the curious fact that we employed the inverse Lorentz transformation by substitution into 1a to obtain 1b, when the logical procedure of transformation is to employ the Lorentz transformation direction to the coordinates as follows:

(6) $x'=\beta(x-vt)$ and $t'=\beta(t'-vx'/c^2)$, $y=y'$, $z=z'$,

which is the Lorentz transformation. The procedure seems to be wrong in the way that we obtained 1b by substitution of equation 2 into equation 1a. The reason for this last problem has to do with the lack of rigor of the mathematics of relativity. In this theory one simply uses mathematics in any way that one chooses to prove whatever one desires and no particular care is addressed to the problem of rigor and correct and proper procedure. All that matters is that the method gives the desired result and so the theory seems to work as it is supposed to.

To complete the proof that the Lorentz transformations are inverses, equation (6) is substituted into equation 1b and, by a nearly identical procedure to that discussed above, the procedure reduces the resulting equation to equation 1a. Again the trick is to cancel the "cross terms", then rearrange the terms to obtain terms in x on the right and t on the left so that the terms in $(1-v^2/c^2)$ are canceled by the following equality $\beta^2(1-v^2/c^2)=1$.

To complete the traditional proof that the Lorentz transformations form a group, we note that substitution of 2 into 1a produced 1b, and the inverse procedure of substituting 6 into 1b produced 1a, thus completing the required demonstration.

5.2 Refutation Of The Traditional Mathematical Procedure

It will now be shown that the preceding procedure does not transform the origin of the expanding wavefront from S to S' when these frames are in relative motion, as claimed in relativity. The first thing to notice is that if we examine equations 1a and 1b, it seems impossible to believe that this equation can be satisfied for any case where the frames S and S' are not at relative rest, so that they are coincident. That is, the only solution seems to be the one where the frames are not moving. The claim of special relativity theory is that the Lorentz transformations do change the origin of the expanding wavefront in S into an expanding wavefront is S' with center at the origin of S', when the frames S and S' are in relative motion. The following proof refutes this claim. (For complete details the reader is referred to the paper by the author at the General Science Journal titled: Refutation Of Einstein's Principle Of Relativity.)

We take equations 2 and 6 and solve them for $x=x'=0$, which occurs by definition, when the origins coincide at $t=t'=0$. We obtain from this procedure that $t'=\beta t$, $t=\beta t'$ and $x'= \beta x$, $x=\beta x'$ from which we immediately obtain the only possible solutions $t'=t$ and $x'=x$ which occur for $\beta=1$ implying $v=0$ and that there is no relative motion between S and S'. This result shows two things. That the Lorentz transformations do not properly possess the group property of being inverses and that the Lorentz transformations do not produce valid solutions that show that expanding wavefronts are different in frames S and S' because they are not in relative motion. Hence it is not a surprise that the results seem to show that the origin is the same in S and S', because they are not moving relative to each other. Therefore, we must conclude that the method of Lorentz transformation used in special relativity is false and that there must be some mathematical error that has caused the erroneous results.

This conclusion marks the divide between traditional relativists and critics of relativity. Unfortunately, there are historical reasons that confuse the objective evaluation of the proof given here. The first point is that the proof of refutation as presented here was never previously formulated in a specific manner so that the problem could be pinpointed, as is done here. Furthermore, the critics of relativity didn't develop their criticism and formulate the problem with relativity until after the acceptance of the relativity theory had been completed. The criticisms appeared belatedly in the context of anti-Semitic Nazism, and so were easily brushed off by Einstein and his followers. Today the criticisms are still brushed off by mainstream physicists under the belief that critics of relativity are crackpots. This allows them to ignore the long standing proofs that the theory is false.

In the context of the objectives of this paper, the problem is formulated in the following way. If one asserts that there is an actual motion imparted to frames S and S', then it is impossible to make physical sense of the claim that is found in the traditional textbooks regarding the paradox of the spheres. The claim is physical nonsense and that is why there is an admitted paradox. The solution to the paradox is that the Lorentz and inverse Lorentz transforms don't properly form a group, and so their correct solution contradicts the assumed real motion of the frames S and S'. Since it is inconceivable that a real solution exists for the frames in actual motion, one can understand why there is no paradox on this basis. There is no relative motion for the only valid solution case, that is $\beta=1$, hence $v=0$, and so both observers can agree that the wavefront expands from the origin in the same way in both frames when they are both at relative rest. However, this does not solve the main problem. That is why is it that traditional relativity textbooks continue to insist that Lorentz transformations form a group of coordinate transformations between frames of reference in relative motion, and draw false conclusions based upon that idea? This will be assessed in the next section where the thesis is developed that the mathematics used in relativity is erroneous.

5.3 Mathematics Of Affine Transformations

The purpose of this section is to focus upon the problem of moving the expanding wavefront from the S frame into the S' frame. The first question that needs to be answered is this. Why do we need to specify two relatively moving frames of reference in the first place? Why don't we do the calculations in the S frame only. After all, all that is involved is a description of the physics for moving objects, and this description would seem to be valid, whether or not we propose two different rest frames, or just one? The answer as to why, is that this would destroy the claim that the laws of physics are rest frame dependent, and it would appear that that claim is totally false, since it can only be proved by the hypothesis that one needs to have different rest frames. This then flows down to the hypothesis that is fundamental to the paradox of the spheres, that the physics is the same in two different rest frames, which then implies that the observers will disagree about the physics they observe when they compare notes of their observations at a later time. As noted in the previous section, the essential physical problem is whether the mathematics properly captures the physical fact of relative motion between the frames S and S'. From the proof of section 5.2, in the traditional formulation, the mathematics does not properly represent motion between S and S'.

The fundamental claim in the special relativity theory is that the physics of the expanding wavefronts in S and S' are the same in both frames so that the two equations 1a and 1b are physically equivalent. From this claim, one derives the mathematical procedure of solution of the Lorentz transformations. That procedure claims to obtain a transformation of coordinates that represents the mathematical solution for the problem of the simultaneous solution that provides for two expanding spherical wavefronts, that expand from two different origins in relative motion. The naive mathematician would surely conclude that the only possible solutions are for the case where t=t'=0, and the case where there is no relative motion of the frames S and S'. In section 5.2, it was shown that the solution obtained from the Lorentz transformations was the solution for no relative velocity of frames S and S'. Hence the theoretical claim here is that the basis of the spheres paradox are refuted. The spheres in frames S and S' appear to be identical and both have the same origin, because they are the same identical rest coordinate system. That is S is equal to S' in all respects, because there is no relative motion between them.

The author is aware that this claim is not accepted by the mainstream physics. However, it brings up an unresolved problem. If this claim is false, then mainstream physics must produce the proof that actually does show that the frames S and S' are in relative motion, when the Lorentz transformations are being deduced. Unfortunately for mainstream physics, it is improbable that such a proof is possible, for the following reason.

The proof requires that the Lorentz transformations be affine transformations. Stated less formally they are translations of the waveforms in frame S into a description of the same waveforms in frame S'. Since frames S and S' are in relative motion, this requirement implies translatory motion of the waveforms relative to the frames. Translations have no fixed points. Hence the proof would have to show that there are no fixed points in the Lorentz transformations. The reader will be shocked to learn that we already know that the Lorentz transformations do have at least one fixed point, and so they are not translations or more precisely affine transformations. The proof is provided in any decent physics textbook where it is shown that Lorentz transformations are rotations in space-time. Since it is easily found in a math book that a rotation must have at least one fixed point, then the proof follows that Lorentz transformations are not translations. That is, they don't represent physically an actual translatory change in coordinate points, but more likely represent a renaming of points to produce an apparent change in the coordinates.

Let us now investigate the problem of description of the waveform for a frame that actually is in translatory motion. To do this we will go back and reconsider equations 3 and 4. Looking at these equations, we see that what we have is an ellipse that has been shifted in time and space. That is, it has been moved relative to the S' coordinate system, and this is what we require for a mathematical physics that describes motion of frame S' relative to S. We should also note that once we eliminate the cross terms, and cancel out the beta terms, we don't have an ellipse that is shifted in time and space anymore.

Referring back to equations 2 and 3, we see that the shift in space is solved from x'+vt'=0, so x'= -vt'. The shift in time is solved as $t'+vx'/c^2 = 0$, so $t' = - vx'/c^2$. This means that the ellipse described in equations 3 and 4 is moving backwards in time and space as his time parameter t' is ticked off from zero. That is, as the observer at rest in S' is moving forward along the x axis of S, the center of the expanding wavefront is receding, and the same is true for the zero reference of t' time. Hence the observer in S' doesn't see a wavefront expanding from his origin, but he sees it expanding from the origin of S. The disagrees with the claim of relativity textbooks as discussed in section 2.1.

We can assess what the S observer sees as follows. Take equations 3 and 4 and change the primed coordinates into unprimed ones and apply a negative sign to the velocity v. The shift in space is solved from x-vt=0, so x=+vt.The shift in time is solved as $t-vx/c^2=0$, so $t= + vx/c^2$. This means that the ellipse is moving forwards in time and space. That is as the S observer is moving backward along the x' axis, the center of the expanding wavefront is receding, and the same is true for the zero reference of t time. This doesn't quite add up since from the S observers viewpoint the ellipse should be at rest relative to him, but he sees it moving forward. That is, it is now at rest in S', and the S observer is moving backwards away from the source of emission that is at rest in S'. So now we see that the two transformations don't describe the same physical state of waveform motion. The physical situation is a contradictory one. In both cases the observer sees the wavefront receding from his location and this is impossible, so the only way that the observers can agree is if S and S' are at relative rest. Obviously the Lorentz transformations are not inverses.

The above paragraph deserves a more detailed discussion to resolve what is happening physically. The first point to notice is that the procedure applied was to substitute the Lorentz transformation equations, which are conceived as coordinate transformations, into the equations 1a and 1b. Substitution of 2 into 1a produced a change in coordinate system from S to S' so that the observer in S', sees the wavefornt produced by a source at rest in S to be receding from him. The other procedure is to substitute the Lorentz transform equation into equation 1b, which produces equations similar to 3 and 4 but with primed and unprimed variables reversed and signs changed. This equation describes a completely different physical situation, since now the observer sees the wavefront expanding from a source at rest in S' and receding away from him. Hence by this analysis , we see that the two transformation equations describe two different physical cases, that are mirror images of each other. Another thing is that the method shows that what the observers see, based on this analysis, contradicts what the observers are supposed to see according to the special theory of relativity. The main reason for discussing it this way is that one is forced to ask, how was it possible to have two completely different physical descriptions that basically arise from the same procedure of substitution of transformation of coordinates into equations 1a and 1b? That is given equations of the form 3 and 4, was it a correct procedure to reduce them to 1b, as shown in 5, given that this procedure contradicts what a logical mathematical analysis says in actually happening physically?

It seems logically evident from the previous discussion, that the substitution of Lorentz transformation coordinates procedure being used above, applies to two different physical cases, one with a rest source in S and another when the rest source is in S'. When we try to solve the two different situations physically, as is attempted by relativity, we get a solution that the two frames S and S' are the same rest frame and hence both describe the same physical process in the same identical way as is claimed by the relativity textbooks. Put differently, either S is the rest frame, or S' is the rest frame, or both S and S' are rest frames but there is no relative motion of S and S'. This contradicts relativity which asserts S and S' are both rest frames that are in relative motion. Thus is seems inescapable that the Lorentz transformations are improperly derived and used incorrectly in relativity physics. Put differently, the mathematical procedure that takes 4 and reduces it to 5 and then to 1b, must be false.

5.4 Alibi and Alias Transformations

The solution to the puzzle of why relativity obtains a false transformation solution, is found from a consideration of the mathematical conception of alibi and alias transformations. The thesis is as follows. The reduction of equations 3 and 4 to equations 5 and 1b is basically an alias identity transformation. That is it is not a physical change but a renaming of the coordinates in a way that maps 1a into 1b in a physically false way. Before proceeding to the proof, a little mathematical background is needed.

The best discussion of the of the alibi and alias concept is given by Alan D. Campbell, in section 11, of Advanced Analytic Geometry, John Wiley, 1938, page 18. The definitions will be restated in modern terminology of affine varieties since the equations 1a and 1b are properly called affine varieties in the modern mathematical terminology. An alias transformation is what is commonly called, or referred to in the relativity literature as a transformation of coordinates, since a change in the axes of reference, or a change in the frame of reference is involved. The alibi transformation is the name assigned to a change in the affine variety or what is commonly called the locus or curve of points, while keeping the frame of reference the same.

The physical interpretation to be assigned to these two concepts is as follows. We take an affine variety to be the curve or locus of points that describes the physical position of the waveform described in 1a or 1b. Under an alias transformation, we change the axes of reference from S to S' so that the physical description in S, becomes an equivalent physical description in S'. In other words we changed the axes of reference, or we changed the point of view of the observer, from what is observed in frame S to what is observed in frame S'. Hence an observer in S' sees a waveform at rest in S moving, because his point of view is in motion. But an observer at rest in S sees no motion.

We take an alibi transformation to be a physical change in the affine variety so that it is moved within the same frame of reference. That is we move the affine variety in terms of its coordinates of definition so that it represents a physical change of position of the wavefront relative to the axes of the frame. So to represent a translation or motion in S, the alibi transformation transforms the coordinates that describe the location of the variety in S relative to its axes of reference. Hence this process is a mathematical representation of motion in S. It doesn't represent a change in observer viewpoint, since the change is relative to S. Hence the observer at rest in S sees the waveform moving in an alibi transformation. If the frame S' is co-moving with the affine variety, the observer at rest in S' sees no motion.

Proof that the traditional relativity interpretation of Lorentz transformations in section 5.1 is false. The proof proceeds by showing that the physical interpretation of the Lorentz transformations as given in section 5.1 is not a proper alias or alibi transformation of coordinates. It is easily demonstrated from the definitions given above. By the definition of an alias transformation, the observer at rest in S' observing the waveform generated in S, and observed in S to be at rest according to 1a, sees the waveform moving relative to S'. But the equation 1b deduced from the Lorentz transformation procedure in section 5.1 describes a waveform at rest in S', which contradicts the definition of an alias transformation of coordinates. By the definition of an alibi transformation, we take equation 1b, to be a waveform moving in S that an observer in S' sees at relative rest in his frame. But according to 1a, the observer in S sees the waveform at rest in S, and not moving as the definition of an alibi transformation requires. Therefore, the traditional Lorentz transformations in 5.1 that transform 1a into 1b and vice versa are neither alias or alibi transformations of coordinates and so it must be mathematically a false transformations. QED

5.5 Self Adjoint Transformations

An additional complication is that when we have quadratic forms there are four transformations and not two. The additional transformations are properly self adjoint or dual transformations. The traditional Lorentz transformations are not inverse transformations but are properly called self adjoint, because they are not proper group inverse operations. This problem has been solved in previous papers by the author and the correct presentation of Lorentz transformations involves four equations as follows:

The Lorentz transform 6 and its self adjoint dual 2:

(6) $x'=\beta(x-vt)$ and $t'=\beta(t'-vx'/c^2)$, $y=y'$, $z=z'$, (2) $x=\beta(x'+vt')$ and $t=\beta(t'+vx/c^2)$, $y=y'$, $z=z'$

The proper or correct inverse Lorentz inverse transformation (7) and its self adjoint dual (8):

(7) $x=\beta^{-1}(x'+vt')$ and $t=\beta^{-1}(t'+vx/c^2)$, $y=y'$, $z=z'$ (8) $x'=\beta^{-1}(x-vt)$ and $t'=\beta^{-1}(t-vx/c^2)$, $y=y'$, $z=z'$,

In section 5.1, it was shown that the paradox of the spheres is based on a mathematical mistake. That is it is an incorrect solution for equations 1a and 1b. We learned that the only solution exists for the case where there is no relative motion of the frames S and S'. This explains the paradox, since there is no relative motion, both observers do see the expanding wavefront as a sphere centered on their common origin. In section 5.3 we learned that another reason why the paradox is based upon false mathematics, had to do with the problem of the shifting of coordinate reference frames. That is when we shift reference frames we shift the physical interpretation as well. But the mathematics does not allow us the luxury of multiple reference frames without contradiction. Therefore we need the additional conception of alias and alibi transformations to resolve the difficulties of the erroneous relativity mathematics.

Here we will show how the problem is solved correctly. Some of the ground work was already laid in section 5.1 so we will take up the narrative by referring back to equations 3 and 4. To transform what an observer at rest in the S' frame sees, when it is moving relative to the S frame we obtain equations 3 and 4 as above. We interpret these as the equations of an expanding wavefront produced by a source at rest in S. In the frame S' the equations describe an ellipse with a center of expansion that is receding from the observer at rest in S'. Now to transform what the S' observer sees to what an S observer sees, we substitute equation 8 into equation 4 with the expectation that this will transform equation 4 into equation 1a, which indeed it does. Hence equation 8 is the correct inverse transformation of coordinates from S' into S and the correct inverse is not equation 6 as claimed by relativity.

Lets review this procedure. We started from 1a, assuming S as the rest frame, and substituted 2, and obtained 3 and 4. To get back to 1a we substituted 8 into 4 and got back our starting point which was 1a. By a similar process we can do the same for 1b, if we assume S' is the unique rest frame. We substitute 6 into 1b then substitute 7 into the resulting equation and get back 1b. Thus it is equations 2 and 8 that are inverses if we assume S is the rest frame. If we assume S' is rest frame, we see that 6 and 7 are the inverse operations. Now we have a group, but we now have four operations and that is a new mathematical fact. Since we know that both S and S' can not be rest frames, what do these additional equations do? The answer is they are the self adjoint, or dual transformations. However more discussion of the answer to this question is not within the scope of this paper.

6.0 Discussion Of Mathematical Results

The objective of this project was to investigate the paradox of the spheres, and that turned into a problem relating to the validity of the derivation of the Lorentz transformations. The author has written a number of papers on the invalidity of the Lorentz transformations, and derived the correct transformations many years ago. (See: "Correct derivation Of Lorentz Transforms Eliminates The Contradictions Of Einstein's Relativity," available at The General Science Journal) The analysis presented here validates the conclusions of that paper.

The problem of the paradox of the spheres was reduced from a paradox within the special theory of relativity to a completely different problem. The resolution of the paradox of the spheres is accomplished by the demonstration that there is no paradox as a result that the two observers in S and S' see the same thing, or experience the same observations. Both observe isotropically expanding wavefronts, because they are both at rest with respect to the source of the wavefront. This is essentially the same result as published in the physics textbooks, but they maintain the incorrect claim that the frames S and S' are in relative motion, and that is not consistent with the mathematical solutions of this problem. The causality paradox problem discussed is section 2.3.1 is thus removed, resolving that problem. The simple solution is that the traditional Lorentz transformations produce solutions only for the case $\beta=1$, hence $v=0$ and the frames S and S' have no relative motion. The transformations therefore reduce to the identity: $x=x'$,$y=y'$, $z=z'$, $t=t'$. Using this substitution we easily get 1b from 1a and 1a, by substitution into 1b.

The Principle Of Relativity Problem discussed in section 2.3.2 is also resolved. Because the frames are both at rest, there is no problem about how both observers can obtain the same results for two different frames in relative motion. In section 5.3, it was shown that the mathematics does show that there is a definite difference in what the two observers see. One sees an expanding isotropic sphere centered at rest in his frame, and the other sees the center of the same wavefront receding or moving away from him due to his motion. It is clear that this is the correct mathematical description of the physical situation and that the relativistic description is incorrect.

The Lorentz group problem is resolved since the correct procedure, shows that the correct coordinate transformations do form a group of transformations as required by the group property, but the transformations derived from this analysis are different from the ones used in relativity. Hence the mathematical claim that the Lorentz transformations derived in that theory form a group is refuted and definitely shown to be false.

Another satisfying aspect of the mathematical results derived here is that it provides confirmation of the long standing claims in the dissident literature that the Lorentz transforms are incorrect. There has been a lot of controversy over the years regarding the validity of the Lorentz transformation equations. One analysis was presented by Wallace Kantor in a paper published in Physics Essays with the title, Lorentz Transformations Reconsidered, Volume 2, Number 2, 1989, page 152. On page 154, at the beginning of the paragraph following equation (7c), Kantor says: "It follows...that γ^2 must be unity...The symbol v ($\neq 0$), assumed to represent relative uniform rectilinear motion in the fundamental kinematics ...in the *postulated* Lorentz transformations is deduced ($c\neq\infty$) to be zero, representing the contradictory state of relative rest." In the conclusions this point is repeated as follows: "...the symbol v, representing a presumed *nonzero* speed of relative translatory motion, in the Lorentz transformation is paradoxically deduced to be zero....A simple resolution, unwelcome to most physists, presents itself:The Lorentz transformations are untenable.” The significance of this result obtained by Kantor, is that it confirms the analysis and the conclusions developed here. The same result, that the only valid solutions arise for v=0, was obtained independent of Kantor, and without a prior knowledge of his results and method.

Another critic, Robert J. Hannon, also derived the result that the Lorentz transforms are only valid for the case v=0. This paper; A Simple Algebraic Analysis and Its Relation to the Einstein-Lorentz Transformations, Physics Essays, Volume 11, Number 3, 1998, page 353, states in its conclusion that: “The present analysis does not aim at disputing other more lucid analyses used to derive the Einstein-Lorentz transformations. Rather, it aims at pointing out that the obscure analysis by Einstein should be reviewed in order to explain why the physics behind the analysis seems to be correct and general, whereas the algebra seems to be confining the physics to trivial cases, such as v=0, i.e., for inertial frames not moving relative to one another...”.

7.0 Are The Lorentz Transformation's Derived By A Valid Procedure?

To finish up the discussion of the findings of this paper, some comments should be given to address the obvious difficulties in the results obtained in this paper. The most obvious objection is the usual one, that is that the results given here must be wrong, since it is impossible for such a silly mistake to have been made by the experts of the physics establishment. This difficulty has some credibility given the large number of papers published on the Lorentz transformations and the high level of mathematical analysis involved. After 100 years you would think that this is a settled problem and that nothing new could come out of challenging the physics establishment on the correctness of relativity.

The answer is that the falsity of relativity has been an unsettled issue for over a 100 years and it is only the physics establishment who think that the issue is settled. The dissident scientific community does not.

This writer thinks that the procedure whereby the Lorentz transformations were derived by Einstein is false, because he took time to be a variable in the transformation of the affine variety of 1a into the affine variety 1b. Properly addressed,, time should be a parameter of the motion and not a variable of transformation. We saw in this paper how Einstein's mistake is not confirmed by the mathematics of coordinate transformation that involves motion. That is because in relativity, no account is taken of motion at all. That is why the result turns out to be that there is no relative motion of frames s and S'.

The source of the problem is that the Lorentz transformations of special relativity are derived in a four dimensional Minkowski space-time. There the Lorentz transformations are rotations. But their use in physics applies them as translations in three dimensional space and time, where time is a parameter. Now since four dimensional rotations in Minkowski space-time have a fixed point they can not be translations in three dimensional space and time, because translations have no fixed points. The fundamental mystery that puzzles this writer is how rotations in Minkowski space-time can be conceived as translations. Hence we get the mistake that Lorentz transformations derived as a group in four dimensional space-time as rotations, are applied as a translation group in three dimensions. Obviously it is erroneous to do this since the Lorentz transformations don't form a group in this application of physics. Rotations are not the same as translations. That simple observation is all one really needs, in order to see why the mathematics of relativity is being false applied in physics.

Summary and Conclusions

The reader who rereads section 2.3 will see that the problems posed and questions asked didn't make much sense, or seemed to be confused and obscure. That is because the problem posed was that of the paradoxical nature of a claim made by Einstein's special theory of relativity. That claim is very unclear and obscure, and it is based upon incorrect mathematics. It wasn't until we got to grips with the mathematics, that the problem and its resolution became clear. The solution is quite simple, the claim made in the theory of relativity regarding the paradox of the spheres is simply false. The equations 1a and 1b are not equivalent, except for the case when there is no relative motion of the frames S and S', and so there is no mathematical justification for a physical paradox. There is no mathematical paradox either. The mathematics involved in the claim, which is deduced from the Lorentz transformation formalism, is simply false. That is all there is to this problem, and its solution is to use the correct and proper mathematical transformations which are presented in section 5.5.

Appendix

1.0 Introduction

The purpose of this appendix is to discuss a very simple proof that the paradox of the spheres leads to the conclusion that the Lorentz transformations are only valid when the relative velocity frames S and S' is zero. There are two reasons for presenting this proof in an appendix. The first one is that this particular proof came to my attention after I had completed the main body of the paper presented above, and the second is that this particular proof sparked a rather heated and prolonged debate that involved a number of participants and generated a number of opinions as to its validity, true and false.

Here the author's updated version will be presented first, and then an attempt will be made to review the controversy that this approach created. The main point will be to show that the correct way to resolve the controversy, which is the conclusion that the relative velocity of frames S and S' must be zero, would have been the correct resolution of the bitter controversy, rather than the protracted bitter and nasty arguments that actually occurred. There will be no attempt to review the controversy in detail, but to make the point that the controversy was fueled by the insistence of one participant to mislead and confuse the argument, rather than bring it to a logical conclusion.

2.0 Proof That The Lorentz Transforms Are Valid Only For V=0

The problem is set up in the same way as presented in section 2.1. A source at rest in S emits a very narrow pulse of light or an expanding spherical shell of photons. We have as a result equations 1a and 1b. As a result of the equivalence defined in equation 1, the Lorentz transforms are deduced. We present the Lorentz transformation equation 6 as follows: A-1 $x'=\beta(x-vt)$ and $t'=\beta(t-vx/c^2)$, $y=y'$, $z=z'$.

We consider the event when the light wave or photons arrive at a position on the positive y' axis in frame S', so that the x' coordinate is zero. Lets call the event (0,y',0,t'). That is the wave pulse or photon arrives at the specified point y' in S' at time t'. From 1a we have that: $x^2+y^2+z^2=(ct)^2$, so y=ct since x and z are zero, and from 1b we have:$x'^2+y'^2+z'^2=(ct')^2$, so y'=ct', since x' and z' are zero. From this we deduce that t=t' since y=y' according to A-1. Now since according to A-1, the time equation is t'= βt, the equations solve so that t'=t and so β=1, and hence v=0. From this we see that the two spheres can only be transformed from 1a into 1b when they are at rest relative to each other. This is the solution discussed in the main body of this paper.

In the original proof this was not the conclusion. There the result was that the result t'=t contradicted the result t'=βt. Hence there was a fault or inconsistency in the Lorentz transformation procedure. This was what triggered the controversy. To see why there erupted a controversy consider the following. By A-1 we deduce the event in frame S is (0,y,0,t) and it is transformed into the frame S' as (-vt, y, 0,t'). However, there is a difficulty, by the procedure used to reduce equation 4 to equation 5, the cross terms are removed and we arrive at (0,y',0,t'). This last step turns out to be the source of the controversy. If we use A-1 to arrive at the result (-vβt,y,0,βt) in S', we are saying that the light sphere in S' is not centered on its origin, and that would imply that the procedure used to deduce 5 from 4 and then to obtain 1a is false.

The substance of the method of proof is to assume that the equations in 1 that is 1a and 1b are valid deductions from the principle of the invariance of light velocity. Then from 1a and 1b a contradiction is deduced that invalidates A-1. The rather obvious solution to the difficulty is to realize that 1a and 1b can not be different descriptions of the same physical process, and so relativity is only valid when there is no relative motion of S and S'.

3.0 I.J. Good's Browbeating Controversy

Given the above background, the controversy will be discussed. I.J. Good, a rather vociferous partisan of special relativity, took it upon himself to refute the argument given by Szego and Ofner, which was basically similar to the above. Good begins by asserting, "A defender of the faith is confident in advance that their argument must be fallacious and my purpose is to expose the fallacy." Right here we are on our guard, because Good does not consider the argument for its merits, but is simply looking for some excuse to find it in error. This leads Good into a wilderness of confusion and into a long and confusing debate. The ironic result is that, in his search for the fallacy, Good finds the wrong fallacy, that is he argues in the following manner. In order to refute the argument, Good argues from principles not consistent with the principles upon which the theory of relativity is based. He argues from the principle of an absolute space time, and thereby concludes that the argument he intends to refute is false, because he proves there is no contradiction with relativity. On the other hand, Good's opponents will base their arguments upon the principles of the special relativity theory and find a contradiction.

Good's argument considers a photon traveling up the y axis, and because, as he tells us, "An event on the y' axis is not an event on the y axis, except when t=0." So Szego and Ofner are mistaken and they should now nobly admit it." The demand that his opponents admit to being wrong is the source of much future trouble, because of its rude and mean character, which was the source of the debate becoming personal and not able to reach a resolution. But there is a rather obvious fallacy on Good's part. Good assumes that this mistake is made by Szgeo and Ofner, and he is unaware that the mistake is found in the many relativity textbooks as discussed in section 2.1. In fact the mistake stems from the paradox of the spheres, as found in relativity books. So Good is demanding that Szgeo and Ofner admit to a mistake they did not make. It is a mistake that is made by the theory of relativity. So if Good is correct in finding the fallacy, it is a fallacy in relativity and not in the argument made by Szego and Ofner. Put differently, Good finds that the fallacy resides within the claim that equation 1 is an equality and that equations 1a and 1b are correct. That obviously would merely kill relativity by a different route. But Good, as a defender of the faith, seems to not know the basic tenets of the faith that he is defending. Hence, one can see that his argument, rude as it is, was bound to head into further trouble.

The reply by Szego and Ofner, was designed to mollify the argument and clarify the difficulty. They say regarding Good's argument concerning events on the y and y' axis: “We think that such an observation can not be reliably made and interpreted using Einstein's Special Theory Of Relativity (STR).” Unfortunately in their exposition of what they meant by this statement, that is the limitations of the theory itself, they did not make clear that the assumptions used followed from the special relativity theories assumptions as expressed in equations 1a and 1b. In other words, what they said was, the fault was with the theory that leads to the paradox of the spheres as discussed in section 2.1.

The full extent of the controversy will not be repeated here. The basic point is that as a defender of the faith, Good proceeds to shred the tenets of relativity, while defending it. By the end of the process, one can not make sense of either side of the argument. All one can properly infer is that if the argument can not be resolved, then it must mean that the theory itself is faulty because it can not be understood in any way by participants in the argument. To summarize, the fault lies in the different ways that the claims of relativity are perceived and understood. Szego and Ofner, see difficulties that lead to problems that can produce serious misunderstandings. While Good sees no problems and proceeds to undermine his own belief in the theory by shredding it in the process of what he thinks is defending it. What is not realized, and what is missing in the debate, is that there is a solution to the mess created by the controversy. That is that the equations can be solved only for the case when the relative velocity between the reference frames is zero. But this was not the objective. Good's objective was to drive his opponents into admitting that they were seriously in error by browbeating them into submission. Hence the debate was not fundamentally scientific in its objectives.

What we have discovered in this appendix, is that there is much mischief to be encountered in the study of special relativity, and much trouble to be brought upon oneself by suggesting that there just may be some errors in the theory. One very good example is the paradox of the spheres, discussed in this paper. Attempts to bring to the scientific community an awareness of the difficulties involved in dealing with relativity led to a rather nasty controversy with I.J. Good, who was on a mission to expunge all such talk that relativity had problems. In this process of debate, the confusion was multiplied, and nothing was resolved regarding how to understand relativity and fix its rather glaring and obvious problems.