

Chapter One: A Brief Overview of SRT Jeff Alford

Abstract: Introduction to Einstein's two postulates (Postulate 1 and Postulate 2), on the one hand, and Einstein's five modifications (space transformation, time transformation, relativity of simultaneity, and mass energy equivalence), on the other.

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1. Definitions:

Einstein's Two Postulates-

- 1) Postulate One: Principle of Relativity- "...for every reference system in which the laws of mechanics are valid, the laws of electrodynamics and optics are also valid." (Miller, pg. 370)
- 2) Postulate Two: Principle of the Constancy of the Velocity of Light- "Light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body." (Miller, pg. 371)

Assumption about light which follows when one puts Einstein's two postulates together-

Light is propagated in empty space with a definite velocity c with respect to every reference system in which the laws of mechanics, electrodynamics, and optics are valid.

Modifications which follow from Einstein's assumption (stated above)-

- 1) Space Transformation
- 2) Time Transformation
- 3) Mass Transformation
- 4) Relativity of Simultaneity

Relationship which follows from Einstein's assumption:

- 1) Mass Energy Equivalence Relationship

2. Introduction

Einstein starts The Special Theory of Relativity (SRT) off, in his 1905 paper, with the introduction of two postulates. These two postulates, when taken together, produce an assumption about the velocity of light, upon which the remainder of his theory is built. This is the assumption that light travels isotropically (same speed in all directions) at c , when it travels through empty space, with respect to all "inertial coordinate systems". "Inertial coordinate systems" are those systems within which the laws of mechanics (and the laws of electrodynamics and optics, as well, according to Einstein) remain valid.

Four modifications and one relationship follow from this assumption (see definitions, above).

In this paper, we explore Einstein's postulates, on the one hand, and the modifications/relationship on the other.

3. Issues of Resistance

I believe that Einstein's Theory of Relativity (Both SRT and GRT) is totally bogus. (Please see note 1 on this section).

Most people immediately dismiss the possibility that Einstein was wrong, on the grounds that 1) Einstein has proven himself to be one of the most intelligent scientists that ever lived, so how could someone of mediocre intelligence refute his theory, 2) if he was wrong, wouldn't it have been noticed by the great scientists since Einstein's time, and

refuted accordingly, 3) the theory has withstood experimental and theoretical scrutiny for over 100 years, so how can it be wrong, or 4) if the theory is so ambiguous, how come it came to be accepted in the first place ?

Since this immediate reaction is so strong, and since this reaction can bias the opinion of the reader, I have decided to put responses to these concerns in my notes. (Please see my notes for this section).

4. Einstein's Assumption of Light Isotropy Introduced

Now that I've addressed the main issues of resistance to the possibility that Einstein could be wrong, it is time to describe the basics behind the Theory of Relativity.

Einstein created two theories of relativity: He created SRT in 1905 and he created GRT in 1915. SRT is based on the assumption that light travels at a constant velocity (through empty space) with respect to all inertial coordinate systems. Einstein's GRT (General Theory of Relativity) is based on the assumption that light travels at a constant velocity (through empty space) with respect to all inertial and non-inertial coordinate systems. As can be seen, SRT is a subset of GRT. We will be exclusively considering SRT in this paper.

Einstein's assumption as mentioned above follows from the mutual consideration of two postulates in SRT: 1) That the laws of physics (mechanics as well as electrodynamics and optics) remain the same (valid) in all inertial frames of reference, and 2) that light travel at a constant speed in a vacuum.

5. Einstein's First Postulate

Einstein's first postulate states that the laws of physics remain the same in all non-accelerating (inertial) frames of reference. Let us briefly consider where Einstein obtains his first postulate. Einstein introduces his first postulate as a generalization or extension of (what Einstein considers to be) a previous law which applied only to gravitation/mechanics.

Specifically, Einstein takes it as a given that the laws of mechanics remain the same in all non-accelerating frames of reference. This is called the Relativity Principle of Mechanics. Then he shifts this statement to also correspond to laws of electrodynamics and optics. This is called the Relativity Principle of Electrodynamics. After making this shift, he can assert that all laws of physics remain valid in non-accelerating frames of reference. This is called the Relativity Principle.

Most people, including relativity proponents and relativity opponents alike, do not have a problem with accepting the Relativity Principle of Mechanics. However, several relativity

opponents have a problem with the Relativity Principle of Electrodynamics. Such people interpret that Einstein didn't have enough justification to make this shift.

Einstein admitted that it takes some faith to make this shift. Such is the reason that Einstein tried to justify it. Exactly how did Einstein justify this shift?

There is much dispute as to how, precisely, Einstein tried to justify this shift. In the first paragraph of his 1905 paper, he makes mention of the fact that magnet/conductor phenomenon can be explained from two points of view: 1) from a reference frame at rest to the magnet, and 2) from a reference frame at rest to the conductor. It is speculated that this argument is related to his justification for making the shift. Also, as apparent from his postulate, Einstein viewed nature as though laws of physics are valid in certain sets of frames of reference. With such a view of nature, it appears as though it seemed sensible to Einstein that the territory for validity of all laws of physics (mechanics as well as electrodynamics) should remain the same.

6. Einstein's Second Postulate

Einstein's second postulate is that light travels through empty space at speed c . The author believes that the connection between postulates one and two is more clear if we alter the second postulate to state the following: "It is a law of physics (electrodynamics and optics) that light travels through empty space at speed c ." Note that in this amended restatement of Einstein's second postulate, we have added the qualification "It is a law of physics (electrodynamics and optics) that...". (see my notes for more clarification as to the reasons for this necessary amendment).

7. Postulate One + Postulate Two= Assumption A about Light Isotropy

Einstein's first postulate is that all laws of physics (mechanics as well as electrodynamics and optics) remain valid in all inertial reference frames. Einstein's second postulate is (as amended above) that it is a law of electrodynamics and optics that light travels at the constant velocity of c through empty space. As a law of electrodynamics and optics, the velocity of light through empty space proposition should remain valid in all inertial reference frames.

Notice here that the first postulate defines the territory for the validity of laws of physics (all inertial reference frames). The second postulate is a velocity-of-light statement about one of these laws of physics. As a law of physics, the velocity-of-light statement should be valid in the territory that all laws of physics are valid in (inertial systems).

Restated, if all of the laws of physics must remain valid in all inertial reference frames, and one of those laws of physics is that light travels through empty space at the constant velocity of c , then it follows that light must travel at the constant velocity of c in all inertial reference frames.

The above description of the relationship between Einstein's two postulates, and how they combine to produce his overall assumption about the velocity of light, is an inference that the author has made, and may or may not be shared by the scientific community. For one thing, it required the amendment to the second postulate, namely, the additional qualification "It is a law of electrodynamics and optics that...". Reasons for making this inference are described in more detail in the notes to the various sections.

Although the scientific community may not be in agreement as to how, precisely, postulate one and postulate two combine, one idea is shared. This is that the combination of his postulates somehow generates the assumption that light travels through empty space at the constant velocity of c , with respect to all inertial coordinate systems. This assumption about light is the basis for the remainder of Einstein's SRT, and consequently, the basis for the remainder of this paper.

Note that we can restate Einstein's assumption as follows: Light travels isotropically at c in all inertial reference frames. (See note 5). This terminology will be used throughout the remainder of this paper.

8. Rods and Clocks

Now that we have gotten past the tricky business of how Einstein's postulates combine to produce his assumption about the velocity of light, we can focus exclusively on the assumption itself, and the implications of this assumption, and leave the postulates behind us. (This may bring a sigh of relief, but don't worry, there are still some sticky patches to come).

Einstein foresaw that his assumption about the velocity of light would threaten the notions of absolute space and time between frames, when the frames are allowed to move with respect to one another. He foresaw that he would have to modify space and time between frames, when the frames were allowed to move with respect to one another. But he wished to preserve the notions of absolute space and time between frames, when the frames were chosen to remain at rest relative to one another. To the extent of this wish, he sought to argue why it is that the notions of space and time (and simultaneity) can be considered to remain absolute throughout an arbitrary frame of reference.

To accomplish this goal, Einstein considered an arbitrary reference frame to consist of rigid rods and clocks, at rest to one another and at rest to the frame itself. His assumption about the velocity of light, as applied to this single frame of reference, stated that light would travel at the same speed of c with respect to this frame, throughout the frame. He claimed that the clocks would only be good clocks (i.e. suffice to define an increment in

time) if they could be synchronized. (see note 1 and 2 for this section). Einstein used, as a synchronization technique, the out-and-back propagation of a light signal (see note 1).

Only if the clocks remained at rest to one another would the distance between them not change, during the synchronization process. It followed that the clocks had to remain at rest to one another for the synchronization process to be employed properly. The above argument led Einstein to establish the assertion that, for an arbitrary reference frame, space, time and simultaneity remained absolute throughout the frame

9. Relative Space and Time

Einstein's assumption states that light travels isotropically to all inertial reference frames/observers. It is easy to see why this assumption of light isotropy would call for drastic reinterpretations of the notions of space and time between reference frames (or observers), when we consider two frames/observers moving relative to one another.

Consider the following freeway thought experiment: Consider three cars on the same side of the freeway. Car one is parked on the shoulder of the road. Car two is traveling at 40 MPH in the slow lane. Car three is traveling at 60 MPH in the fast lane. Assume that cars two and three pass car one at the same time (an event). Cars one and two represent reference frames or observers. Car three represents a light pulse.

Car two is viewed by car one to travel at 40 MPH. Ordinarily, car three would be viewed by car one to travel at 60 MPH, and by car two to travel at 20 MPH. Why is this? One might be inclined to say that it follows from the laws of mechanics. But that is not the case. This actually follows from a much more fundamental principle of the law of addition of velocities.

Now let us say that car two is not allowed to view car three as traveling at 20 MPH. Rather, car two is told that he must view car three to be traveling at 60 MPH, just like car one. This requirement represents Einstein's requirement (or assumption) that all inertial observers (and reference frames) view light to travel at c with respect to themselves.

At first glance, this requirement appears impossible. That's why Einstein says his second postulate is apparently irreconcilable with his first postulate, in the third paragraph of his 1905 paper. However, Einstein attempts to rescue the assumption/requirement by proposing that space and time are modified between cars one and two. It should not be surprising that space and time are messed with to achieve a velocity desired, since velocity is the space traversed divided by the time elapsed.

Einstein is hereby proposing than an amendment to the law of addition of velocities is in order, when we consider that what we are measuring is the velocity of a light pulse.

10. Actual Derivations of Space and Time Transformations

I know of two primary derivations of the space and time transformations. Both consider an event (i.e. creates light) to occur where and when observer S' passes observer S. This event will create a spherical wave front which must remain concentric in both systems ("The paradox of the sphere"). The first derivation considers the whole spherical wave front. The second derivation considers only a pulse (or set of pulses) of this wave front which goes out, hits a mirror, and then comes back to hit observer S'. See Wheeler, Hawking or Young for derivations. (Wheeler, Spacetime; Hawking, Brief History of Time;; Young, University Physics).

11. Relativity of Simultaneity

Einstein had established absolute simultaneity, within the context of a single frame via the synchronization of his clocks in a given reference frame. Einstein uses the train thought experiment (after 1905) to demonstrate that simultaneity is relative between reference frames moving relative to one another.

An observer is placed in the middle of a running train (systems S') and on the ground (system S). The observer on the ground watches the train as it passes. Just as the two observers pass one another, two lightning bolts strike the ends of the train. We consider the two pulses of light created by the lightning bolts that will eventually converge with each of the two observers. It is argued that the two pulses will eventually hit the ground observer at the same time but that they will hit the train observer at different times. It is argued that because the ground observer is struck with the light pulses at the same time, he will conclude that the lightning struck each end of the train at the same time. It is argued that because the light pulses hit the train observer at different times, he will conclude that the lightning struck the two ends of the train at different times. Hence, relativity of simultaneity of events between two observers moving relative to one another.

12. $E=mc^2$

Einstein didn't derive the mass energy equivalence relationship in his 1905 paper. Rather, he showed that it was a byproduct of his theory later that same year.

13. Apparent Disagreement with Experiment-Stellar Aberration

Einstein's assumption is that light travel isotropic to inertial observers. Bradley was such an observer. Bradley found that the light coming to us from the stars does not travel isotropic to his telescope (or to him). Rather, the light travels isotropic to the stars. This apparent discrepancy compelled Einstein to reconcile the theory by deriving the stellar aberration formula in section 7 of his 1905 paper. For more details, see my paper. (Alford, Light Isotropy-Theory and Experiment).

14. Apparent Internal Contradiction-Twin Paradox

The most famous apparent internal contradiction inherent in Einstein's Theory is labeled the Twin paradox. Basically the argument proceeded between Dingle and Einstein, as follows:

Dingle: SRT doesn't prefer any one frame to any other. Therefore, the predicted modifications must be reciprocal. That is, whatever S views of S', so S' must view of S. So I will view you to age more slowly and be thinner than me, and you will view me to age more slowly and be thinner than you. How can this be?

Einstein: Mutual comparisons cannot be made while we are in motion relative to one another. We must be at rest to one another to make these contradictory conclusions.

Dingle: Relative age between twins can be compared after a Buck Roger's-type starship journey. Twin A and twin B are the same age the day twin B takes off in a spaceship. When he comes home, A should view B to have aged less, while B should view A to have aged less.

Einstein: The situation is asymmetrical in nature because B is accelerating to the earth while A is not.

Dingle: We can consider that both twins get on a spaceship and go in opposite directions.

Einstein: This situation is no longer within the realm of SRT because the twins A and B must accelerate and decelerate relative to the earth on the out and back trips. GRT can reconcile this apparent discrepancy on the basis that the acceleration suffered by the two twins is not reciprocal/symmetrical.

(See note for more detailed information)

15. Violations to Intuition-Empiricist Arguments

Einstein is aware of the fact that it is bold to assert that space and time are relative. This is because, as he says, the notions of absolute time are intuitively pleasing. The notions of relative space and time run counter to basic intuition. Einstein defends his bold assertions on the grounds that intuition, itself, can be faulty.

Intuitive notions, says Einstein, are formulated via sensory experience (Empiricist claim-see note). While sensory experience may be familiar with measuring the velocity of cars and the like (i.e. slow moving phenomenon), we are not familiar with measuring the much faster phenomenon of the velocity of a light ray.

It is for this reason, he argues, that we may resist amending the law of addition of velocities, or equivalently, amending the notions of absolute space, time, mass and simultaneity.

16. Conclusion

Einstein begins SRT with two postulates which, when taken together, lead to the “assumption” about the velocity of light, which states: Light travels isotropically at c with respect to all inertial observers. A list of the interchangeable terms, dropped terms, and added terms, in order to arrive at this result, is given in the notes to this section.

The remainder of SRT follows from this “assumption” about the velocity of light. To keep this assumption true (i.e. the “assumption may be more appropriately termed as a “requirement”) we find that four modifications and one relationship are in order, namely 1) space transformation, 2) time transformation, 3) mass transformation, 4) relativity of simultaneity, and 5) $E=mc^2$. The modifications follow from consideration of Einstein’s “requirement” about the velocity of light, within the context of two observers, moving relative to one another.

Reasons for the modifications of space and time can best be seen from a simple Freeway Thought Experiment. Reasons for the modification of simultaneity can best be seen from Einstein’s Train Thought Experiment.

Since Einstein predicts he will have to propose relative space, time, and simultaneity between frames, when the frames are allowed to move relative to one another, he finds it necessary to reiterate precisely why we can sustain/preserve the notions of absolute space, time and simultaneity between frames when the frames are not allowed to move relative to one another (or what amounts to the same thing, prove why the absolute notions can be preserved in an arbitrary frame of reference, throughout the frame of reference).

Einstein rebuts apparent experimental contradiction with his theory (Stellar Aberration) in his 1905 paper, and he rebuts apparent theoretical contradiction in his theory after the publication of his 1905 paper (in conversations with Dingle). Einstein defends his proposed counterintuitive modifications after the publication of his 1905 paper, via Empiricist arguments.

17. Notes to Various Sections:

17.1 Definitions-Notes

Note 1: Often times the student becomes confused with understanding the distinction between Einstein’s second postulate and his assumption about the velocity of light. It is important to realize that Einstein’s

assumption about the velocity of light follows from taking postulates one and two together (it does not follow directly from postulate two). If Einstein's assumption about the velocity of light followed directly from postulate two, Einstein would have no reason for introducing the first postulate.

Postulate two doesn't make any claims about the reference systems that light travels at a constant velocity with respect to. Postulate one fills in this gap.

For a more elaborate discussion on Einstein's Two Postulates, the relationship between them as well as what each means when viewed separately, please see my paper "Einstein's Two Postulates" (Alford, Einstein's Two Postulates).

Note 2: Note, from the way that the first postulate is introduced, that Einstein takes it for granted that the reader is aware of the reference systems for which the laws of mechanics remain valid. Einstein labels these reference systems "inertial reference systems" in other texts by him. (Einstein, Relativity). These are reference systems which can move at a constant translational (without rotation) velocity with respect to one another.

If you are like most people today (relativity opponents and proponents alike), then you agree with Einstein that it is known that the laws of mechanics remain valid in inertial frames of reference. This is the postulate one as applied to the context of mechanics. It is also known as The Relativity Principle of Mechanics.

But some relativity opponents feel that Einstein doesn't have enough evidence to shift this principle over to the domain of electrodynamics and optics. For further discussion on this point, see my paper. (Alford, Einstein's Two Postulates).

Note 3: Note that Einstein is talking about the velocity of light when the light travels through empty space. He is making no claims about the velocity of light traveling through material mediums. In some experiments which test SRT, the light is traveling through material mediums (i.e. Airy, Fizeau, etc.). The experimenters are not ignorant of the fact that SRT only discusses the velocity of light through empty space.

Rather, the experimenters regulate the temperature of the medium to make sure that it is homogeneous in space. They are interested in measuring the isotropy of light through the empty space between the molecules in the liquid or solid. It is a tricky issue to determine where SRT ends insofar as making a prediction of the propagation of light through the pockets of empty space in these mediums. Admittedly, the author even has trouble with this issue.

Note 4: Note that Einstein is making no claims about what the precise value of light is found to be. Rather, Einstein is saying, whatever it is, it is a fundamental constant in nature. Given that the value is c , he is saying that light will travel at c with respect to all "inertial reference frames". This is statement about the isotropy of light more so than it is a statement about the actual velocity of light. For further discussion see my paper. (Alford, Light Isotropy-Theory and Experiment).

Note 5: Note that a portion of postulate two is actually redundant. When Einstein states that the light will travel at c , independent of the emitting body, he needn't add "independent of the emitting body". This is because he is trying to get to the assertion that light travels at c with respect to inertial reference frames. If the light travels at c with respect to inertial reference frames, then it follows that the light will not travel at c with respect to the emitting body (unless the emitting body just happens to be at rest to the inertial reference frame under consideration).

The fact that Einstein was being redundant here does not necessarily indicate that he made a mistake. Rather, Einstein most likely just wanted to emphasize that he was not a proponent of the Ballistic Theory. This is especially likely when we consider the fact that he had effectively implied in the preceding paragraph of his 1905 paper that the Stationary Ether Theory should be abandoned.

In other words, it's like he's saying this: We got a null result from the Michelson Morley Experiment so we should abandon the Ether Theory and start this new one I've created. But let me be clear, this new one I created in no way resembles the Ballistic Theory. It is a different theory altogether.

17.2. Introduction-Notes

Note 1: In Rickers paper, Refutation of the Length Contraction and Time Dilation Conclusions of Einstein's Special Theory of Relativity, section 2.2, paragraph 2, he states "...there are at least five versions of Einstein relativity (the 1905 version, the 1907 version, the 1910 version, the 1916 version of general relativity, and the Minkowski version)." In this paper, we consider exclusively the 1905 version of relativity.

17.3. Issues of Resistance-Notes

Note 1: You may be wondering, and rightly so, "Why is the author talking about issues of resistance, when this is just supposed to be a paper that introduces the theory?" Allow me to save you the time in discerning whether or not I subscribe to SRT. I do not.

It is inevitable, if you continue reading my work, that you will figure this out sooner or later. In the interest of saving you time and energy, I prefer to be upfront about where I stand.

I will try to presents the theory as objectively as possible, but I cannot help but comment on what I view to be errors in Einstein's logic. The errors I find are not merely my opinion-they are fact.

I will present the theory as conventionally as possible, and I will make my best efforts to bury my somewhat controversial ideas in my notes, or in other papers where the topics are discussed in greater detail.

When I tell people that I do not subscribe to SRT, I am met with such resistance, to the extent that I have found it relevant (if not necessary), to deal with these issues at the outset, before proceeding.

Note 2: To the first concern, I have this to say: There can be no doubt that Einstein was a great scientist, but his Theory of Relativity converges with philosophy-and Einstein was a questionable philosopher. Furthermore, Even Einstein himself, toward the end of his life, admitted to questioning whether or not his entire Theory of Relativity was just a house of cards built on the wrong foundation.

What really helped me in accepting the notion that Einstein could possibly be wrong was noticing errors in his logic. In other words, I slowly found out that he wasn't as smart of a guy as everybody thinks he is. He's extremely smart, but he makes a lot of logical mistakes. At first I automatically assumed he never made logical errors, but I was forced to accept the notion that he did make logical errors when I looked at all the potential ways of interpreting what he said and realizing that, no matter what he meant, what he said leads to logical fallacies. In specific, I was first led to believe in flaws in Einstein's Theory through a six month intensive study of his Train Thought Experiment, and looking at all the potential ways that it can be interpreted. For more details on Einstein's Train Thought Experiment, see my paper. (Alford, Problems with Einstein's Train Thought Experiment).

At first, I just though the Theory was flawed and needed to be revised, but as I saw more and more errors in Einstein's logic pop up, I began to doubt the validity of the theory in its entirety. I have now come to the point where I know he's wrong-it's just a matter of figuring out what was going on in his mind to admit the peculiar interpretations he had.

What that above reveals to me is how big of a stumbling block it can be to begin with the automatic assumption that Einstein was so much smarter than everybody. The truth of the matter is that he wasn't nearly as smart as most top scientists, and he made a lot of errors.

Note 3: To the second concern, I have this to say: Einstein's Theory of Relativity is difficult to refute because it is ambiguous. One reason few scientists discover its inadequacy is because the theory's flaws are buried in a cloud of ambiguity. Most scientists just accept the consequences of the theory without scrutinizing the theory itself. Also, there have been several scientists which have disagreed with the theory, only they have not been publicized. And finally, Einstein's Theory of Relativity is a conventional theory. To speak out against it means jeopardizing your career. Scientists are reluctant to question it out of the repercussions of their actions.

Note 4: To the third concern, I have this to say: The experimental evidence which supports Einstein's theory is difficult to interpret.

Look at the Michelson Morley experiment. The Michelson Morley experiment is used in literature as supporting evidence of Einstein's theory because the experiment disproved the then longstanding Stationary Ether Theory. What the literature doesn't say is that there are other theories, such as the Ballistic or Entrained Ether, that are supported by the Michelson Morley results as well. For more details, see my paper (Alford, Light Isotropy-Theory and Experiment).

Look at the phenomenon of mass increase from Kaufmann's experiments. Einstein's Theory predicts mass increase, but so does Max Abraham's self-induced mass theory. Popular literature doesn't discuss this theory but Jackson does. For details relating to Kaufmann's data, see Cushing or Miller. (Cushing, Philosophical Concepts in Physics; Miller, Albert Einstein's Special Theory of Relativity). For details concerning the self-induced mass theory, see Griffiths, Jackson, or Miller. (Griffiths, Introduction to Electrodynamics; Jackson, Classical Electrodynamics; Miller, Albert Einstein's Special Theory of Relativity).

Look at the phenomenon of the increased lifetime of fast moving disintegrating particles. To be consistent with Einstein's theory, one must take several leaps of faith when interpreting this phenomenon. One such leap of faith is the assumption that disintegrating particles define time for us only when they are at rest to us (not at rest to the earth, but at rest to us). According to Einstein, if we could ride on the particle we'd find that the lifetime of the particle is not increased. It takes a leap of faith to interpret this because we cannot ride the particle and find out. Moreover, the extended life can be alternatively explained as a mere consequence of mass increase (i.e. slowed vibration). For more details, see Alford, Essen, and Gibilisco. (Alford, Future Considerations-After SRT is ruled out; Alford, Measuring Devices-In Theory and in Practice; Essen, The Special Theory of Relativity: A Critical Analysis; Gibilisco; Einstein's Theories of Relativity).

Also, there is no evidence of Einstein's prediction of either length contraction or relativity of simultaneity. This is not to say that experiments disagree with length contraction or relativity of simultaneity-just that no experiments can be designed to test them.

And finally, Einstein's famous result of $E=mc^2$ was actually derived five years earlier from totally different assumptions. For more details, see Ives and Stillwell (Ives and Stillwell, The Einstein Myth and the Ives Papers).

I have to admit, I find it very weird that Einstein could somehow, from the wrong assumptions, get these same results. I mean, his theory does agree with experiment (to some extent), and that's weird, because I know he started off with the wrong assumptions.

Note 5: To the fourth concern, I have this to say: At the time of Einstein's theory, physicists had all but given up on trying to create a theory that agreed with experiments on light isotropy. The time was ripe for a new theory on light isotropy through empty space to be started from scratch-and Einstein's theory met that requirement. Plus he is obviously an intelligent guy. I'm sure his papers on Brownian motion and the

Photoelectric effect, that same year, afforded him a certain level of credibility. Why not believe it when there is nothing better? That and the fact that, because the theory is so philosophical in nature, it is difficult to refute.

In his paper, “Why no Einstein’s Laws (part IV), section 3, paragraph 5, he states “The author believes that it was the deliberately ambiguous nature of Einstein’s theory that guaranteed its success. His theory was conducive to the principle of relativity as expressed by Poincare, while at the same time also conducive to the ideas of Lorentz expressed in his theorem of corresponding states. It embraced all the elements of success. It was both radical and conservative all at once; a smorgasbord of ideas from which anyone could choose the ideas that he preferred as true.”

Note 6: For more information Related to issues of resistance, see Chappell (Chappell, www.worldnpa.org...)

17.4. Einstein’s Assumption of Light Isotropy Introduced-Notes

Note 1: With regards to postulate 1, sometimes Einstein states that “laws of physics remain the same in all inertial reference frames”, and other times he states that “laws of physics remain valid in all inertial reference frames”. According to Einstein, the two statements are identical. In his 1905 paper, he uses the terminology “valid”. In his book Relativity, he uses the term “same”. (Einstein, Relativity). Still, other times Einstein states that laws of physics “hold good” in reference frames. Whether Einstein uses the terminology “valid”, “same”, or “hold good”, he is talking about the same thing.

Note 2: With regards to postulate two, notice that I took the part out “independent of the emitting body”. I did this merely to eliminate redundancy. (see note 4 in section 17.7).

Note 3: Presumably, the assumption follows because Einstein considers it a law of physics that light travel at a constant velocity in a vacuum. As a law of physics, when considered with the first postulate, it should remain valid in (with respect to) all inertial coordinate systems.

If Einstein didn’t consider the second postulate to be a law of physics, then how would postulate one relate to postulate two? If Einstein didn’t consider the second postulate to be a law of physics, then how could postulate one plus postulate two produce his assumption about the velocity of light. Einstein most definitely meant for postulate two to be a law in physics. He must have. The author considers Einstein’s failure to clarify this a serious blunder. He should have stated his second postulate as follows: It is a law of electrodynamics that light travels at the constant velocity of c through empty space. Without qualifying that he assumes it is a law of physics, it leaves the burden on the reader to make the connection between the first postulate and the second postulate, and infer that Einstein assumed it. For more details, see my paper. (Alford, Einstein’s Two Postulates).

17.5. Einstein’s First Postulate-Notes

Note 1: As mentioned, it is commonly assumed, with Einstein, that the laws of mechanics hold good (remain valid) in all non-accelerating frames of reference. What is implied by this statement is the converse, namely, that the laws of mechanics do not remain valid in all accelerating frames of reference. Einstein did not introduce GRT until 1915. Einstein did not believe that laws of physics remain valid in accelerating reference frames until 1915.

As mentioned, most people, relativity opponents and proponents alike, believe that laws of mechanics remain valid in all non-accelerating frames of reference. But do they believe in the converse? Do such people also agree that, without the consideration of the equivalence principle, the laws of mechanics are not valid in accelerating frames of reference? And would Newton agree with this claim.

The author would like to admit that he doesn't get the principle of equivalence. He thinks it's entirely bogus. The author believes that it is a plain fact that to speak of the laws of physics as pertaining to reference frames at all is imbecile. But the author wishes to explore the logic of Einstein prior to 1915. What exactly is the reason that Einstein thought that the laws of mechanics weren't valid in accelerating frames of reference?

The author would like to propose that Einstein most likely formed this misinterpretation of the laws of mechanics from a misinterpretation of Newton's first law. Newton's first law says that a mass will not accelerate unless it is acted upon by an external force. Einstein most likely considered a single mass, stranded in empty space, uninfluenced by any external forces. Einstein considered that Newton's first law would not remain valid in a reference frame chosen to accelerate relative to the mass since that would imply an external force which doesn't exist. The problem occurs because Einstein is considering that the acceleration implied by Newton is to be taken with respect to a reference frame. The author believes that Newton meant for the acceleration to be taken with respect to the center of mass of a system of masses. The author believes that Newton would consider the reference frame, within which a situation is described, to be arbitrary. Newton would not believe that the validity of his laws can pertain to a reference frame. For a more detailed discussion, see my paper. (Alford, Einstein's Two Postulates).

Note 2: As mentioned, it is speculated that the magnet/conductor phenomenon, described by Einstein in the first paragraph of his 1905 paper, was intended to serve as a justification for his Relativity Principle of Electrodynamics. This author believes such was, indeed the intention of Einstein. But even those who believe this cannot agree on precisely what Einstein was getting at with his magnet/conductor argument, and how it is used to justify the Relativity Principle of Electrodynamics. The author would like to provide the reader with what he thinks Einstein was getting at here.

Einstein interprets that the magnet and conductor experiments involve situations in which the magnet and conductor are moved at a constant velocity relative to one another (but not acceleration with respect to one another). Einstein notes that Maxwell's equations remain valid in a frame of reference glued to the conductor as well as in a frame of reference glued to the magnet. Insofar as the movement of the magnet and conductor is arbitrary, provided there is no acceleration between the two, so is the relative motion between the reference frames arbitrary. Arbitrary, non-accelerated motion implies all "inertial reference frames". It follows that the laws of electrodynamics remain valid in all non-accelerating (inertial) reference frames (i.e. Relativity Principle of Electrodynamics).. For more details, please see my paper. (Alford, Einstein's Two Postulates).

Note 3: The author would like to specify that, in a general sense, reference frames are merely tools, and are not to be used to define the territory for validity of laws of physics. Laws of Physics are not valid or invalid in reference frames, just as they are not valid or invalid for observers. Rather, the validity of a law of physics can be determined as based on the relative motion of objects in the physical world, without reference to a reference frame or observer.

Note 4: In his paper "Why no Einstein's Laws (part III), section 5, paragraph 1, Ricker states "It is clear that the key element of the modern special theory of relativity is the Principle of Relativity. That principle is stated by Einstein in many different ways in his many papers." In his paper "Correct Derivation of Lorentz Transforms Eliminates Contradictions of Einstein's Relativity", section 9.2, paragraph 2, Ricker states that "In the 1905 paper, Einstein refers to the principle of relativity as suggesting that there is no concept of absolute rest. Then he redefines this as meaning that 'the same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good'." In his paper "Why no Einstein's Laws (Part IV)", section 4, paragraphs 1 and 2, Ricker states "In his 1905 paper, Einstein stated the Principle of Relativity in at least three different ways. The first version, given in the introduction, stresses that it is essentially equivalent to Poincare's prior version. It stressed both the

equivalence of the laws of physics and the principle that there is no absolute standard of rest. In section 2, he gives a formal definition of the principle. The statement is quite different from the usual or standard version familiar to students of relativity. Einstein's formal definition is: 'The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to one or the other of two systems of co-ordinates in uniform translatory motion'...In his 1907 paper a formal definition is not given for the fundamental principle which is the subject of that important paper. The following informal definition is given instead: "...the laws of nature are the same without regard to which of the coordinate systems moving uniformly (without acceleration) relative to each other they are referred to." Later in that same paper (section 4, paragraph 13 and 14), he quotes Einstein as stating "'The laws governing natural phenomenon are independent of the state of motion of the coordinate system with respect to which the phenomena are observed, provided this system is not in accelerated motion.' In this version the emphasis continues to be upon the coordinate systems, but there is an attempt to generalize, by making the principle applicable to laws of physics in general, not just the specific laws of mechanics, from which the principle arises, and electromagnetism, which is the new realm to which the principle is being applied.. In Einstein's 1916 paper, 'The Foundation of the General Theory of Relativity', the formal definition for the special theory is rendered in the following form: 'If a system of co-ordinates K is chosen so that, in relation to it, physical laws hold good in their simplest form, the same laws also hold good in relation to any other system of co-ordinates K', moving in uniform translation relatively to K.'"

The current author finds no faults with Einstein's apparent restatements of the first postulate. Ricker hits the nail right on the head when he points out that "In this version...there is an attempt to generalize, by making this principle applicable to laws of physics in general, not just the specific laws of mechanics, from which the principle arises, and the electromagnetism, which is the new realm to which this principle is being applied." Indeed, it is. But Einstein didn't shift his mode of thinking in 1910. He meant this all along. When he introduces the first postulate in his 1905 paper, he states "...for every reference system in which the laws of mechanics are valid, the laws of electrodynamics and optics are also valid." (Miller, Albert Einstein's Special Theory of Relativity, pg 370). That is the important part in that sentence. The rest of the sentence is meant merely as justification for the assertion as mentioned above. Einstein did not intend for his first postulate to be the same thing as saying that there is no concept of absolute rest. Rather, Einstein meant to say that since the null result seemingly prohibits an ether, it thereby prohibits the notion of absolute rest, and this, in turn, can be used as evidence for the assertion that the principle of relativity holds for all laws of physics-not just laws of mechanics.

If we look at Rickers quote in the paper titled "Why no Einstein's Laws (part IV), section 4, paragraphs 1 and 2, he mentions three restatements of Einstein's first postulate. Let us call them one, two and three, respectively. The statement one proceeds from a direct reading of Einstein's second paragraph in his 1905 paper. As mentioned, this author interprets that Einstein's mention of "to the concept of absolute rest" is merely an effort, on Einstein's part, for justifying the principle of relativity (as is his first paragraph of the 1905), not part of the principle of relativity itself. With this interpretation, Einstein's first statement about the principle of relativity in his 1905 is simply this: All laws of physics (mechanics as well as electrodynamics and optics) are valid in all inertial reference frames. This author finds no apparent incompatibility between this statement and statements two and three. Statement two states "The laws by which physical processes undergo change are not affected". Statement three states "the laws of nature are the same." But what is the difference between saying that the laws are not affected and the laws are valid or that the laws are the same. It's all the same to this author. To say that the laws remain unaffected is identical to saying that the laws remain the same, or saying that the laws remain valid (for if they remain the same, and they are valid in one frame, then they are valid in the other frame as well). This author interprets that the statements are interchangeable, and interprets that Einstein never changed his mind on this issue. This author interprets that Einstein was, in fact, consistent in his description of the first postulate.

To be sure, in the first description of the first postulate, Einstein doesn't state explicitly that the laws of physics remain valid in all inertial systems. Rather, Einstein merely states that the territory for validity of the laws of electrodynamics and optics should be the same as the territory for validity of the laws of mechanics, without specifying what the territory is for the laws of mechanics. As mentioned elsewhere in this paper, the author interprets this to be because Einstein takes it for granted that the reader knows that the

laws of mechanics are valid (to a first approximation) in inertial reference frames. The fact that Einstein takes this for granted is important to note.

17.6. Einstein's Second Postulate-Notes

Note 1: Most people, relativity proponents and opponents alike, consider that Einstein's second postulate is ad hoc. But is the second postulate is truly ad hoc, then what is the reason for postulate one, where is the connection between postulate one and postulate two, and what is the difference between postulate two and Einstein's assumption about the velocity of light?

These questions cannot be answered well unless we alter postulate to be stated with the additional qualification "It is a law of physics (electrodynamics and optics) that...". Hence the reason for my proposal to add this in to the second postulate.

When postulate two is viewed with this additional qualification, the relationship between postulates one and two becomes more apparent, the reason for postulate one becomes more apparent, and the difference between postulate two and Einstein's assumption about the velocity of light becomes more apparent. Moreover, with such an additional qualification, postulate two can be viewed as a less ad hoc and more justifiable statement. Specifically, it results because the electromagnetic wave equation, which reveals the speed c , can be derived from the two electrodynamic equations.

As mentioned, most people today assert that Einstein's second postulate is ad hoc. A more appropriate assertion is that Einstein's assumption about the velocity of light, which follows from the mutual employment of Einstein's two postulates, is ad hoc. The author believes that Einstein, himself, would agree with everything contained in this note.

Note 2: With the additional qualification added to postulate two, as described in note one, it also makes it easier for us to interpret the relevancy of Einstein's magnet/conductor argument (in the first paragraph of his 1905 paper), which presumably serves the role as justification for his extension of the relativity principle of mechanics to the relativity principle of electrodynamics and optics. Note "note 2" in section 17.5 for a description of what the author feels Einstein was getting at with his magnet/conductor description, and how, precisely, Einstein considered this as justification for his extension of the relativity principle (from the domain of mechanics to the domain of electrodynamics and optics).

Note 3: In his paper Why no Einstein's Laws (Part III), section 5, paragraph 2, Ricker states "Einstein's second postulate is in this authors opinion contained within the principle of relativity, since the dictum that the laws of physics have the same form or be identical in different frames implies that the constants of proportionality in the equations, in this case the light velocity constant, be numerically identical." The current author very nearly shares this interpretation, but not precisely. In the same manner, the present writer interprets that the relationship between postulates one and two stems from Einstein's interpretation that postulate two is a law of physics (law of electrodynamics and optics) and that as such retains validity or homogeneity between inertial frames of reference. Why Einstein was reluctant to clarify that the second postulate was to be taken as a law of electrodynamics and optics is not known to this author. Einstein's reluctancy might have stemmed from the same reason as his reluctancy to clarify that the laws of mechanics were valid in all inertial frames of reference when he first introduced his first postulate in his 1905 paper-that is, because he assumed everybody knew what he was talking about.

Note 4: In his paper Why no Einstein's Laws (part V), section 5, Ricker states: "Here we will see that he (Einstein) gave different and consequently confusing definitions of his principle of light constancy in his different publications. In his different papers he gives the following definitions:

(1a) 1905: 'light is always propagated in empty space with the definite velocity c which is independent of the state of motion of the emitting body.'

(1b) 1905: 'Any ray of light moves in the "stationary" system of co-ordinates with the determined velocity c , whether the ray be emitted by a stationary or moving body,'

(2) 1907: 'We now assume *that the clocks can be adjusted in such a way that the propagation velocity of every light ray in vacuum-measured by means of these clocks-becomes everywhere equal to a universal constant c* . Provided that the coordinate system is not accelerated.' (Italics in the original.)

(3) 1910: '*A ray of light in vacuum always propagates with the same velocity c , which velocity is independent of the body that emits the ray.*' (Original in italics.)

(4) 1912: 'There exists a coordinate system with respect to which every light ray propagates with the velocity c .'

(5) 1915: '...every light ray in a vacuum always propagates (at least with respect to a certain coordinate system K), with the definite velocity constant c .'

(6) 1917: '...relative to every inertial system -given the correct definition of time- the theorem of the constancy of the speed of light holds true.'

(7a) 1920: '...one has to accept as an expression of experience (e.g. from the Michelson Experiment): the systems K and K' are equivalent with respect to the law of light propagation. Experience shows at least that also with respect to K' , all directions are optically equivalent.'

(7b) 1920: 'In this conclusion, the validity of the principle of the constancy of the speed of light has been assumed -in agreement with the principle of special relativity- for both systems K and K' .'

(7c) 1920: '...according to the principle of relativity the propagation of light must be the same relative to K as it is relative to K' , the *same* process of propagation relative to K' must also be described by a spherical wave of propagation velocity c .'

This author would like to point out the following interpretations of the statements as given above:

(1a) This is a statement of postulate 2.

(1b) This is a statement of postulate 2.

(2) The first sentence is a statement of postulate 2. But to add sentence two is to add postulate 1.

(3) This is a statement of postulate 2.

(4) This is a statement of postulate 2.

(5) This is a statement of postulate 2.

(6) This is an implication of postulate 1.

(7a) The first sentence is an implication of postulate 1. The portion in parentheses represents Einstein's attempt to justify the first postulate, but it is not a very good one. The second sentence is also a statement of postulate one (that laws of optics remain valid between moving frames of reference), but it is not very well-written.

(7b) This is an implication of postulate 1.

(7c). The portion before the comma is an implication of postulate 1. The portion after the comma is Einstein's velocity of light assumption which follows from the mutual employment of postulates 1 and 2.

When Einstein states that 'light travels through empty space at the constant velocity of c , which is independent of the motion of the emitting body', it is the same as saying 'light travels at the constant velocity of c ', period. "Through empty space" is eliminated for brevity. "Which is independent of the emitting body" is also eliminated for brevity. To say 'light travels at c ', is identical to saying 'light travels at c relative to some arbitrary coordinate system'. Only when we compare coordinate systems are we transcending beyond postulate two. (Postulate 1 compares reference systems). To say 'light travels at c in S ' is different from saying that 'light travels at c in S and S' , moving relative to one another'. The former is postulate two. The latter is the combination of postulate one and two. Postulate two never refers to more than one frame of reference. Postulate one refers to the set of inertial reference frames.

This author interprets that Einstein remains consistent, throughout his life, as to the meaning of postulate two (and postulate one, for that matter). Confusion commonly arises because readers fail to recognize the

distinction between Einstein's second postulate and his assumption about light, which follows from mutual employment of postulate one and postulate two. Remember, there must be a reason Einstein introduced postulate one, and Einstein states that Postulate one is apparently irreconcilable with postulate two.

17.7. Postulate One + Postulate Two= Assumption A about Light Isotropy-Notes

Note 1: The word "assumption" is my terminology. Please remember that when I use the word "assumption" or requirement, when speaking about the velocity of light, I am not referring to Einstein's second postulate exclusively. Rather, I am referring to the assumption about light which follows from putting postulates one and two together".

Note 2: Note that it is Einstein's assumption about the velocity of light which is ad hoc, not postulate two. Note "note 1" in section 17.6.

Note 3: Einstein's assumption about the velocity of light is usually stated as follows: Light travels through empty space at the constant velocity of c with respect to all inertial observers. This assumption can also be stated as follows: Light travels isotropically at c , through empty space, with respect to all observers. There is no difference in the two statements. "Isotropic" means "same speed in all directions". We are merely replacing "constant velocity of c " with "isotropically at c ". They both imply that an event will create a spherical wave front of light traveling outwards at the constant (i.e. to be sure, this is redundant to say "constant" here) velocity of c .

Note 4: Note that, once in a while, authors will drop the term "through empty space". This is not because they don't know any better, but because it can get tiresome and cumbersome to continually qualify "through empty space". It should be known that whenever we are talking about the velocity of light, within the context of SRT, the light is considered to travel "through empty space". It is implied, and shouldn't need to be restated. This author will also sometimes drop the term "through empty space".

The term "independent of the emitting body" is dropped for an entirely different reason. This term is dropped because it is redundant. If light is traveling at the constant velocity with respect to a reference frame, it follows that it will be traveling independent of the emitting body unless the body is at rest to the reference frame. (See note two in section 17.4.)

Note 5: Considering notes 3 and 4, above, we can state Einstein's assumption as follows: Light travels isotropically at c in/with respect to all inertial reference frames. This is the author's favorites way of stating the assumption, and it will be used in this paper.

Note 6: In his paper "Why no Einstein's Laws (Part III), section 5, paragraph 3, Ricker states that "The second postulate is not a principle that leads to the Lorentz transformations, but a result that comes out of them." The current author does not believe that this reverse description of the second postulate with the Lorentz transformations would be an accurate portrayal of SRT. Lorentz and Einstein had very different *reasons* for deriving the Lorentz transformations. Lorentz sought to reconcile the stationary ether theory with the Michelson Morley null result. Einstein sought to make an assumption about the velocity of light first, which differed from the stationary ether hypothesis, and agreed with the Michelson Morley null result, and second to develop modifications necessary to sustain such an assumption. Hence, the reason for viewing the Lorentz transformations as the result of postulate two within the context of SRT.

Note 7: In his paper, "Einstein's False Interpretation of the Velocity Addition Law", section 1, paragraph 2, Ricker states that "The second postulate states that the numerical constant in the light speed equation is the same in all inertial systems." This is not true. Einstein's second postulate says nothing about what systems the numerical constant will be the same in. It is only after putting postulates one and two together that one can make the statement Ricker makes. Notice that whenever Einstein clarifies his second postulate, he never mentions which reference frames it corresponds to. Such is the job of postulate one. If Ricker's

statement about postulate two were true, there would be no need for postulate one. And there would be no “apparent disagreement” between postulates one and two, like Einstein says there is. In the third paragraph of Einstein’s 1905 paper, Einstein states “...introduce another postulate, which is only apparently irreconcilable with the former...” (Miller, Albert Einstein’s Special Theory of Relativity, pgs. 370-1). Ricker’s mistake is a classic mistake of misunderstanding the distinction between Einstein’s second postulate with Einstein’s assumption about light, which follows from the mutual employment from his two postulates. Ricker’s mistake follows from an identical mistake made by Kadel. Note Note 4 in section 17.6.

Note 8: In his paper “Relativity Redux: The world year of Physics”, Introduction, paragraphs 3 and 4, Babin states: The two postulates, which serve as the basis for special relativity are,

1. The Laws of physics are the same in all inertial frames of reference,
2. Any ray of light moves in the ‘stationary’ system of coordinates (absolute vacuum assumed throughout) with the determined velocity [c], whether the ray be emitted by a stationary or by a moving body.

On the basis of the second postulate, A. Einstein concluded that the relative motion of an object with respect to an observer was the cause of the contraction of space, dilation of time, and increase in mass. Furthermore, this was not a mere appearance, but a physical modification. A contradiction obviously arises because of the first postulate. Since either frame of reference can be considered in motion, the modifications would be reciprocal and therefore not discernible.”

The current author agrees with Babin’s restatements of Einstein’s two postulates, however, he does not agree with the conclusions derived from them. Notice how Babin states that the modifications arise purely from postulate two. Again, Babin’s misunderstanding of postulate two stems from a failure to distinguish postulate two from Einstein’s assumption about the velocity of light, which follows from the mutual employment of postulates one and two. If Einstein could derive his modifications from postulate two alone, then what would be the purpose of his first postulate? Wouldn’t Einstein have left it out, especially considering that it could only lead to implied contradictions, as noted by Babin.

17.8. Rods and Clocks-Notes

Note 1: In his paper “An Analysis of the Theoretical Foundations of Special Relativity”, section 3, paragraph 5, Babin states “...there is no reason provided by Dr. Einstein for restricting the method of synchronizing clocks to the use of light waves.” Walter Babin correctly asserts that Einstein has no basis for demanding that the clocks must be synchronized via light signals. If it can be assumed that the material medium in space is homogeneously dense and homogeneous in temperature, between one location and another, the type of out and back signal transmission to employ synchronization should not depend on the type of signal sent out and back. One might just as well use reflecting sound waves. To be sure, the sound waves would not provide the level of accuracy as determined via the light signaling process, but accuracy is not the issue at hand. In principle, the light signaling procedure is identical to one in which sound waves, instead of light pulses, are sent out and back. Babin also asserts that the clocks could be synchronized by the “slow clock” transport method, which is true as well.

The author will even go one step further. Einstein’s synchronization process is used to establish that simultaneity is absolute in a given reference frame. To the extent that this is established, Einstein is justified in using the synchronization process. However, the synchronization process is also used to establish that the notions of absolute space and time are preserved in a given frame. Einstein has no basis for asserting that, by synchronizing the clocks in a given frame, absolute space and time is preserved. The synchronization process, in fact, makes use of the implicit assumption that space remains absolute

throughout the frame. For greater details, see my note 4, below, and my paper. (Alford, Measuring Devices-In Theory and in Practice).

Note 2: Notice that Einstein here makes no mention of disintegrating particles as good clocks. He just says that the clocks have to be synchronized. The faith in disintegrating particles as good clocks came after the fact that it was noticed, experimentally, that the lifetime of a naturally disintegrating particle increases when it travels fast (always with respect to the earth). We did not set out to test Einstein's time dilation; the experimental evidence came to us (quite literally, in fact, i.e. muons created in upper atmosphere). Only after noticing the apparent increased lifetime did we re-perform the experiments in a lab with artificially created disintegrating particles.

According to Einstein, it should make no difference whether we use a mechanical clock or an atomic clock to tell time. What matters is if they can be synchronized. To be sure, an atomic clock will tell more accurate time, but the level of accuracy is not the issue here. In principle, according to Einstein, a clock should be a good clock if it can be synchronized. See my paper for more details. (Alford, Measuring Devices-In Theory and in Practice).

Note 3: Harry Ricker, in his paper titled "Herbert Dingle was Correct! An investigation of the first refutation of Relativity", investigates an argument employed by Dingle which was constructed to expose an inconsistency in Einstein's derivation of time transformation. Dingle derives an inverse Lorentz transformation, suggesting that moving clocks run fast (not slow). The relevant material is the first three paragraphs of his section titled Theory of Clock Comparison in Special Relativity. There Ricker notes that "A clock is generally defined today as a system which produces an output without an input. What this means is that a clock measures time by counting the vibrations or beats of a self-sustaining oscillatory system."

This may very well be the most accurate definition of what a clock really is, but this author does not believe that Einstein was even aware of this when he wrote his 1905 paper. Einstein makes no mention, in his 1905 paper, of the requirement that a clock be composed of an oscillatory system. If this is true, and Einstein was truly unaware of how a clock works in practice (in 1905), the implication is that Einstein thought he could define what a good clock is without knowing about the internal workings of a clock. It follows that, in principle, if one were able to build a clock that didn't operate on such oscillatory motion, it could be a good clock, so long as the clock could be properly synchronized.

In other words, the fact that Einstein makes no mention of the requirement that a clock operate on vibratory motion tells me that Einstein interprets that clock credibility is independent of the internal workings of the clock. This, in turn, suggests to me that Einstein was proposing that the definition of a good clock depends entirely on whether or not it can be synchronized, not on how it operates.

Einstein may have changed his mind in 1907 or 1910, when Dingle proposed his argument, but in 1905 he felt the way as described above.

Note 4: Notice that Einstein never "proves" that space remains absolute in an arbitrary frame. On the contrary, he merely assumes that it is, and then asserts that the clocks will be good clocks if they can be properly synchronized. If Einstein wanted to "prove" that space remains absolute in a given frame, he would have to make a "plausibility" argument as to why "rigid rods" can be relied upon as true measurements of space. He mentions, peripherally, that the coordinate system is to be made up of rigid rods; however, he doesn't proceed to argue as to why the rigid rods can be relied upon as reliable measuring apparatuses. See my paper for more details. (Alford, Measuring Devices-In Theory and in Practice).

Note 5: It is here that Einstein illustrates the fundamental importance of a reference frame (of rods and clocks). Einstein's notion of a reference frame is much more than that of a mere mathematical tool. Einstein may have gotten used to the idea of a reference frame as serving as more than a mere mathematical tool through his studies of the stationary ether model. The stationary ether stood as a large rigid reference frame, itself. Prior to the introduction of his SRT in 1905, Einstein had viewed all motion as relative to this great stationary ether frame (note the term "absolute motion" in the second paragraph of Einstein's 1905 paper).

Also, as is evident from his presentation of his first postulate, Einstein viewed laws of physics as remaining valid in reference frames, as though the laws of physics somehow pertained to reference frames. It is evident, therefore, that Einstein placed a great deal of credibility in the notion of the reference frame, even before he created SRT.

Note 6: In his paper “Einstein’s False Derivation of Time Dilation”, section 2, Ricker states “Einstein gives two distinctly different methods. One based on clock dial comparison and another based on clock frequency comparison. The first is the basis of the 1905 paper and the 1912 Manuscript and the second is the basis of his 1907 and 1910 papers.” Notice that in this paper we do not discuss clock frequency comparison. This is because this paper is restricted to the 1905 version of SRT. Hence, we are only concerned with clock dial comparison.

Note 7: Ricker points out another fallacy by Einstein which he states as follows: “ Starting with the assumption that clocks and rods in two different reference frames are identical, the theory concludes that they are different. This is a contradiction.” (Ricker, A Contradiction is not a Paradox, section 2, paragraph 2). In another paper, he states: “ Here it is implicitly assumed that the standards of measure for these coordinates are the same in the two identical reference frames labeled S and S’. Hence it is explicitly assumed that a measurement distance defined at rest in system S is identical to one defined in S’ (Light Velocity is a Ratio, It can not be Absolute, section 2, paragraph 1)..

This is certainly a tricky issue, but one that warrants further scrutiny. The current author does not believe that it is implied that the rods and clocks for two different frames are identical, from Einstein’s presentation of the subject. The present author feels that Einstein merely stated that rods and clocks remained the same for a given frame of reference. But a given frame of reference is an *arbitrary* frame of reference. Einstein is not comparing rods and clocks from one frame to rods and clocks in another frame, until he derives his modifications. Two observers, S and S’, moving relative to one another, might use the same process (synchronization), to establish measurements in their own frame, but it does not follow that they will have the same standards for reference. It is one thing to say that the same process is used to come up with a system of meters and seconds, but it is quite different to say that the meters and seconds established will be equivalent. Note that Einstein is developing the notions of homogeneous time and space for an arbitrary frame-he is saying nothing about how such notions will compare between frames (yet).

Note 8: For more information about clocks in SRT, please see Ricker’s paper “Herbert Dingle was Correct (part IX).

Note 9: In his paper, “An Analysis of the Theoretical Foundations of Special Relativity”, section 2, paragraph 6, Babin states “It is further stated by Dr. Einstein that a common time for coordinates A and B occupying the same inertial frame and separated by a distance cannot be defined unless it is established by definition that the time required by light to travel from A to B equals the time from B to A. Since experiments to accurately determine the speed of light have, to this point, been averages of two-way motion, this arbitrary definition is of no practical use...”. The current author interprets that Babin’s assertion is correct.

17.9. Relative Space and Time-Notes

Note 1: Note that in order to interpret the extended lifetime of naturally disintegrating particles as evidence for the effect of time dilation, faith is required. Specifically, the following act of faith is required: assume that the disintegrating particle still decays rapidly as viewed by an observer riding on the particle. In other words, we have to assume that the disintegrating particle, as a clock, remains valid for all observers at rest to the clock. Remember, the responsibility of a clock is to define increments in time. And Einstein assumes that a naturally disintegrating particle represents such a clock for all observers at rest to the clock.

The late great John Chappell described this idea more eloquently than I can, so I will quote him here: “Einstein is praised for having made a ‘leap of faith’ beyond the pedestrian reasoning of Lorentz and others, by claiming that when clocks slow down in a relativistic fashion, it is really time itself that is slowing down. But every bit of alleged evidence proves, at most, nothing more than the clock slows down. Too many physicists subscribe to the belief that there is nothing to time except what can be seen on the face of a clock; but that amounts to the ridiculous statement that a measuring device has been built to measure nothing but itself. This view is an extreme version of operationalism, a very simplistic version of Machian positivism. So the ‘leap of faith’ claiming time dilation remains totally unsupported by facts; mere speculation, not science”. (Chappell, www.worldnpa.org/main...). (This is a great source to read about issues of resistance as well). Also, for more details, consult my paper. (Alford, Measuring Devices-In Theory and in Practice).

Note 2: Note that the terms “inertial reference frames” and “inertial observers” are interchangeable. Sometimes the author will drop one or the other. But note that what is said for one, pertains to the other as well.

Note 3: Note that the terms “requirement” and “assumption” can be used interchangeably. This author will sometimes use the term “requirement” and other times use the term “assumption”, depending on the context.

Note 4: The terms “reference frame” and “observer” are usually interchangeable, as in the context “inertial reference frames/observers”. We can assume that an observer is taking the measurements of the clock readings, in the synchronization process.

Note 5: Note that the terms “inertial” and “non-accelerating” are interchangeable. An inertial reference frame is nothing more than a non-accelerating reference frame. Sometimes this author will use “inertial” and sometimes this author will use “non-accelerating” depending on the context.

Note 6: Note that to say that an observer “will view light to travel at c ” is identical to the statement that light travels at c relative to the observer. The term “view” implies that the observer is looking from the perspective of a frame of reference at rest to himself.

Note 7: Note that Einstein states that his second postulate is apparently irreconcilable with his first postulate, the third paragraph of his 1905 paper. Specifically, he states “introduce another postulate, which is only apparently irreconcilable with the former” (Miller, Albert Einstein’s Special Theory of Relativity, pgs 370-1). This, in turn, helps us understand/infer the connection between Einstein’s two postulates. He doesn’t say that his second postulate, alone, is apparently irreconcilable, but rather that the two postulates, when taken together, are apparently irreconcilable. This also helps to clarify the distinction between his assumption and the second postulate.

In a previous note, the author inferred that the second postulate needed to be amended. Specifically, add the term “it is a law of electrodynamics and optics that...”. The author feels that this is the only interpretation of Einstein’s second postulate that can be made to establish apparent irreconcilability between the two postulates.

Note 8: The relativistic interpretation of the experiments dealing with time dilation and mass increase. Experiment suggests that the “inertial” mass of charges goes up when they travel very fast. Experiment also suggests that the lifetime of naturally disintegrating particles goes up when they travel very fast. The relativistic explanation actually relies on the assumption that neither of these things really happens. Rather, the relativistic explanation says that it only appears as though the “inertial” mass goes up and that the lifetime goes up. Let me explain.

According to relativity theory, the lifetime of a naturally disintegrating particle defines a second (or fraction of a second) for any and all observers who happen to be at rest to the particle. According to

relativity theory, the resistance of a charge to accelerate defines a gram (or fraction of a gram) for any and all observers who happen to be at rest to the charge. Therefore, according to relativity theory, the "inertial" mass of the fast moving charges, and the lifetime of the fast moving disintegrating particles, is still the same for the observers riding with these charges and particles (even though it appears to us that they increase).

In other words, the relativistic explanation begins with the assumption that the "inertial" mass of the charge, or the lifetime of the particle, remains the same (as it does when it is at rest to earth) as viewed by an observer riding with the particle or charge. But there is no observer riding with the particle or charge. That is why we have to assume it.

Only after this assumption has been made can the relativistic explanation go on to credit the apparent increase in "inertial" mass or lifetime to a modified (i.e. not one to one) correspondence of grams or seconds (as defined for us observers here on earth) with the same (as defined for a "fictitious" observer riding on the particle or charge). Since the apparent increase in lifetime of the particle (or "inertial" mass of the charge) agrees with the ratio of $1 : \sqrt{1 - v^2/c^2}$, which is spit out by the equations of relativity theory, these experiments are, in fact, considered evidence for SRT.

A Critique of the Assumption Upon which the Relativistic Explanation Relies. As mentioned above, the relativistic interpretation of the experiments (of fast moving charges and particles) relies on the assumption that the charges, as weighing scales, and particles, as clocks, remain reliable (for an observer at rest to them) even though they appear not to be so. Einstein is taking away our freedom to interpret when a measuring device is good and when a measuring device is bad. Einstein is saying, these measuring devices (charges and clocks) will always be good (for an observer at rest to them) even though they appear to be bad.

Let us say we have a mechanical watch. Let us say that this watch seems to work very well. Let us now say that we place this watch under water and that it stops. Are we going to interpret from this that time stops for all observers under water or are we going to interpret that the watch is not water proof? Of course we will interpret the latter. But why? We interpret that the watch is not water proof because we use our common sense to judge that the watch is not a reliable watch when it is placed under water. In other words, we refuse to place more faith in the watch as a reliable measuring device than we do in our judgment as to whether or not the watch can be considered reliable in such a case.

Let us now say that this watch is not a mechanical watch, but a clock which is based on cesium disintegration. Again, this cesium clock seems to keep time very well. In fact, it keeps time even more accurately than did the mechanical watch. However, when we accelerate this clock to great speeds, it slows. Are we going to interpret from this that time slows for all observers riding on the particle or that the cesium clock is not speed proof? Relativity Theory interprets the former. This is because relativity theory places the utmost of faith in the cesium clock as a good clock.

Another relativistic explanation. As mentioned, relativity theory reconciles the decreased deflection of fast moving charges to a modified correspondence of grams between an earth observer and a "fictitious" observer riding on the charge. This is Einstein's mass transformation as viewed by the earth observer. But there is another explanation. This is that the electron will flatten (i.e. contract) just like as in Lorentz's explanation. This is Einstein's space contraction.

My problem with these two explanations is the following: According to relativity theory, both transformations should occur. But only one explanation is necessary to explain the data. If both are assumed to occur, then relativity theory would predict an expected decreased deflection which is too much.

As mentioned, relativity theory reconciles the increased lifetime of fast moving naturally disintegrating particles to a modified correspondence of seconds between the earth observer and the "fictitious" observer riding on the particle. But there is another explanation. This is that the particle observer views the entire earth and its atmosphere to contract. This way, even though the particle observer only thinks he travels three meters during the lifetime of the particle, the three meters is enough to travel the distance of the atmosphere (i.e. because it is contracted).

My problem with these two explanations is the following: To summarize, we have that the earth observer views the time of the particle to dilate and that the particle observer views the space of the earth to contract. But what about the earth observer viewing the space of the particle to contract and the particle observer viewing the time of the earth to dilate? These two modifications go unmentioned in relativity literature (because, of course, they mess up the explanation). My argument here has nothing to do with the whole Twin Paradox type argument, which accuses relativity of a contradiction. I am not trying to accuse relativity of a contradiction. I am only questioning the logic as to why it is that the time dilation (from the point of view of the earth observer) and the space contraction (from the point of view of the particle observer) is discussed, but the time dilation (from the point of view of the particle observer) and space contraction (from the point of view of the earth observer) are not discussed. This relativistic explanation seems biased.

17.10. Actual Derivations of Space, Time and Mass Transformations-Notes

Note 1: Note that the actual derivations derive a factor of Gamma. This factor is then substituted back into either the equation for space or the equation for time, but not both simultaneously. This has the appearance that the space and time transformations occur as alternative transformations, and not cooperative transformations. See Wheeler for an example derivation. (Wheeler, Spacetime).

Sometimes one or the other of space or time transformation is derived directly, but not both simultaneously. This has the same appearance as that mentioned above, namely, that the transformations are merely alternative transformations and not cooperative transformations.

Compare this with common explanations for the alleged time dilation of disintegrating particles. From the point of view of an observer on earth, time dilates but space does not contract. From the point of view of an observer riding on the particle, space contraction is mentioned but not time dilation. But relativity theory states that both observers should measure both time dilation and space contraction. For more details, see my paper. (Alford, Measuring Devices-In Theory and in Practice).

Einstein most definitely asserts that his modifications (of space, time, and mass) occur cooperatively, or together. Einstein may very well have noticed that the mathematics implies that the transformations occur independently of one another. That is, he may have noticed that space transformation, in and of itself, is needed to satisfy his assumption/requirement. And that time transformation, in and of itself, is needed to

satisfy his requirement. And that mass transformation, in and of itself, is needed to satisfy his requirement. But he may have been resistant to the idea that the three modifications represent alternative (not cooperative transformations) because the alternative nature of the transformations would conflict with his theory. If only one transformation is required, then which one is it? So he proposed that all three are required and overlooked what was suggested by the mathematics.

Note 2: The actual derivations make use of the requirement that the mathematical solutions must be linear. It is the author's interpretation that this mathematical requirement translates to a geometrical requirement, in that only certain pulses of light on the wave front are taken into consideration.

Einstein tries to justify this mathematically linear requirement in his 1905 paper with the statement "In the first place it is clear that the equations must be linear on account of the properties of the homogeneity which we attribute to space and time" (Miller, Albert Einstein's Special Theory of Relativity, pg 375).

Sometimes this geometrical requirement is incorporated directly. Such derivations restrict to consideration certain pulses of light on the wave front. See Hawking or Young for an example derivation. (Hawking, Brief History of Time, Young, University physics).

Note 3: Just as the author believes that space and time transformations are alternative, the author believes that mass transformation is also alternative. Consider the statement by Feynman that we find that all that is required is the mass transformation. (Feynman, Lectures on Physics).

Consider, as well, the elegant comparison of mass transformation with time dilation, by considering a mass on a vibrating string. (Gibilisco, Einstein's Theories of Relativity).

Note 4: Zapffe derives mass increase and time dilation for elementary particles via classical arguments. Zapffe, A Reminder on $E=mc^2$, $m=m(0)(1-v^2/c^2)^{-1/2}$, & $N=N(0)e^{-(t'/gt)}$.

17.11. Relativity of Simultaneity-Notes

Note 1: Einstein's Train Thought Experiment necessarily leads to inconsistencies, no matter how it is interpreted. See my paper. (Alford, Problems with Einstein's Train Thought Experiment). Also see Evans. (Evans: Critique of Simultaneity).

17.12. $E=mc^2$ -Notes

Note 1: The mass energy equivalence relationship had actually been derived five years prior to SRT, with entirely different assumptions (Ives and Stillwell, The Einstein Myth and the Ives Papers).

17.13. Apparent Disagreement with Experiment-Stellar Aberration-Notes

Note 1: See references listed at end of this paper for references on Stellar Aberration.

17.14. Apparent Internal Contradiction-Twin Paradox-Notes

Note 1: This dialogue between Dingle and Einstein is significantly watered-down. For more detailed and accurate information related to the twin paradox, see Dingle (Dingle, Science at the Crossroads) or Ricker (Ricker, Herbert Dingle was Correct! Part IV, section 4.3; Ricker, Herbert Dingle was Correct, Part VIII).

17.15. Violations to Intuition-Empiricist Arguments-Notes

Note 1: Einstein can only make these claims because he subscribes to the empiricist philosophy of the attainment of knowledge (and, consequently, reject the rationalist philosophy). The empiricist view is that our minds are blank slabs at birth. The rationalist view is that our minds were slabs that were blank of knowledge at birth, but that even at birth, these slabs were driven by a machine that is aware of certain foundational truths (i.e. intuition). For more information on these two schools of philosophy, see Cushing (Cushing, Philosophical Concepts in Physics).

It is odd to note that even rationalists believe in Einstein's Theory. I am a rationalist and I once believed in SRT. It took a lot of convincing for me to even admit the possibility that it could be wrong.

17.16. Conclusion-Notes

Note 1: Einstein's first postulate states that all laws of physics (mechanics as well as electrodynamics) remain valid in all inertial reference frames. No terms are dropped or added to this postulate, but it is importance to note here the interchangeability of the following terms: "inertial coordinate systems" with "inertial reference frames"; "inertial reference frames" with "inertial observers"; "laws of mechanics" with "Newton's laws and Galileo's laws"; "laws of electrodynamics and optics" with "Maxwell's four equations plus the electrodynamic wave equation"; "remain valid in" with "remain the same in"; "remain valid in" with "hold good in"; "inertial" with "non-accelerating"; "non-inertial" with "accelerating".

Einstein's second postulate states that light travels through empty space at the constant velocity of c , which is independent of the motion of the emitting body. Note that "through empty space" is interchangeable with "in a vacuum". Note that "constant velocity of c " is interchangeable with "isotropically at c ". Note that we sometimes drop the term "through empty space", because it can get exhausting and cumbersome to rewrite it, and because it should be takes as implied. Note that the term "independent of the state of motion of the emitting body" can be dropped because it becomes redundant after combining postulate one with postulate two. Note that we added the term "it is a law of physics (electrodynamics and optics) that..." in the front of the postulate. The reason for making this addition is to 1) clarify the relationship between postulate one and postulate two and 2) to clarify the distinction between postulate two and the assumption of the velocity of light (which follows from combining postulates one and two).

Of all of the interchangeabilities, added terms, and dropped terms listed above, the only one that really should remain under dispute is the last one, namely, that of adding "It is a law of physics that..." to the second postulate.

Considering the above, we can say that Einstein's two postulates combine to create the following assumption about the velocity of light: Light travels isotropically at c with respect to all inertial observers.

Note 2: It is important to note, here, that Einstein takes it as self evident that the laws of mechanics hold good in non-accelerating frames of reference (relativity principle of mechanics), but he does not take it as self-evident that the laws of electrodynamics and optics hold good in the same frames (relativity principle of electrodynamics and optics). The relativity principle of mechanics plus the relativity principle of electrodynamics and optics produces the relativity principle, in general. The relativity principle, in general, is the same thing as postulate one, which states that all laws of physics (mechanics as well as electrodynamics) remain valid in all inertial reference frames.

The reason we know that Einstein takes the relativity principle of mechanics as self-evident but not the relativity principle of electrodynamics and optics as self-evident, is apparent from the say he introduces them in his relativity paper of 1905. He never justifies the relativity principle of mechanics; rather he just says "For every reference system in which the laws of mechanics are valid..." (Miller, pg 370), or "Let us

consider a coordinate system in which the laws of Newtonian mechanics hold..." (Miller, pg 371). Contrast this with the way Einstein introduces the relativity principle of electrodynamics and optics. To promote the idea of the relativity principle of electrodynamics and optics, he presents an argument concerning two perspectives on magnet/conductor interaction. Only after this presentation does he say that the relativity principle can be extended from the mechanical domain to the electrodynamic and optic domain, by saying "Examples of this sort...lead to the conjecture that...for every reference system in which the laws of mechanics are valid, the laws of electrodynamics and optics are also valid" (Miller, pg 370).

18. References

Alford, J. "Einstein's Two Postulates" (Chapter 2A), <http://www.wbabin.net/pprrel.htm>, What they are and the motivating factors for creating them, are examined. The first postulate is given special consideration, both within the context of Newtonian Mechanics and within the context of Maxwellian Electrodynamics.

Alford, J. "Problems with Einstein's Train Thought Experiment" (Chapter 3), <http://www.wbabin.net/pprrel.htm>, . It is examined how Einstein's Train Thought Experiment leads to fallacies, in spite of ones interpretation of this thought experiment.

Alford, J. "Light Isotropy-Theory and Experiment" (Chapter 4). <http://www.wbabin.net/pprrel.htm>, It is examined how the six theoretical models for light isotropy (three ballistic, two ether, and SRT) stand up to the Original Michelson Morley Experiment and to Original Bradley (Airy not considered) Stellar Aberration.

Alford, J. "Problems with the All-Pervading Ether Hypothesis" (Chapter 5A). <http://www.wbabin.net/pprrel.htm>, The current scientific community proclaims that the wave character of light implies a medium present to permit such propagation. Such is considered the reason for the Ether Hypothesis. The reasonableness in making this implication is examined.

Alford, J. "Propagation Geometry and Propagation Character-Two Issues or One Issue?"(Chapter 5B) <http://www.wbabin.net/pprrel.htm>. Currently, the scientific community automatically links ether theory with wave character of light, and ballistic theory with corpuscular character of light. The reasonableness of making these associations is considered.

Alford, J. "Future Considerations-After SRT is Ruled Out" (Chapter 6). <http://www.wbabin.net/pprrel.htm>, Alternative explanations to Einstein's are explored.

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