the general science journal

# Chapter 4: Light Isotropy-Theory and Experiment

**Jeff Alford**

**Abstract:** 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. This paper presumes that the reader has read my other paper "A brief Overview of SRT". The models are categorized according to the convention which the author has chosen. This paper is not quite as speculative as some of my other papers, such as "Problems with Einstein's Train Thought Experiments", "Einstein's Two Postulates", "Problems with the All Pervading Ether Hypothesis", or "Propagation Geometry and Propagation Character-Two Issues or One Issue."

**Contents**



## 1. Introduction

Scientists can estimate the speed of c to within about 300 m/s. This serves as a very accurate measurement of the velocity of light, but it has yet to be refined. Whether or not c can be considered a fundamental constant is up for debate, but one thing is certain-too much credibility is granted to this number. What is the reason for this?

From the perspective of The Special Theory of Relativity (SRT), this number is, indeed, fundamental. With such a focus on c as an absolute, is difficult to consider the possibility of measuring light to be c+v or c-v. But the phenomenon of Stellar Aberration actually

suggests that c has a component velocity. And even the Brillet and Hall terrestrial experiment fails to pick up the earth's rotation. Nevertheless, these experiments are commonly misregarded as evidence for SRT.

Einstein begins his 1905 paper with the introduction of two postulates which, taken together, produce his famous assumption about the velocity of light, upon which the remainder of SRT is built. This assumption states that light travels at c, through empty space, with respect to all inertial observers. There are five other theories which offer like assumptions about the velocity of light when it travels through empty space. Specifically, there are three Ballistic theories and there are two Ether theories.

This paper considers all six assumptions and how they stand up to the evidence provided to us from two experiments: The Michelson Morley and Stellar Aberration. The Michelson Morley experiment is the most popular terrestrial experiment performed to date, while Stellar Aberration is the most popular non-terrestrial experiment performed to date.

When textbooks describe the Michelson Morley experiment, they focus on the only theory (the stationary Ether theory) which apparently disagreed with the null result of the experiment. There are two reasons for this: 1) To make the alternative, SRT, appear more credible, and 2) To introduce the mathematics behind the space transformation.

Suffice it to say that textbooks do not emphasize that this Lorentz matter contraction, although identical in mathematical construct, differs greatly from Einstein's proposed space contraction. Nor do the textbooks even mention the Ballistic or Entrained Ether Theories. The reason for this is because the textbooks don't want to have to deal with the details as to what other experiments proved them wrong (i.e. Airy, DeSitter, etc.).

Perhaps this is justifiable on the basis that one does not wish to get into the details if one does not have to. But is it better the way it stands? With students now confused as to the relevancy of the Michelson Morley Experiment and the Lorentz contraction.

This paper is intended to fill that gap for the student, at least within the context of the Michelson Morley Experiments of 1881 and 1887, and the observed phenomenon of Stellar Aberration by Bradley in 1728.

## 2. The Six Theories of Light Isotropy-Description

There are three Ballistic theories, two Ether theories, and The Special Theory of Relativity.

Ballistic Theory #1 states that light will continue to travel isotropic to the original source of the light. The original source of the light exists at the point in space where matter is either naturally or artificially disturbed. The molecules in stars are naturally disturbed.

The star remains the source of light, for the phenomenon of Stellar Aberration, according to Ballistic Theory #1. The molecules in a laser apparatus are artificially stimulated. The laser machine remains the source of light, in the Michelson Morley Experiment, according to Ballistic Theory #1.

Ballistic Theories #2 and #3 state that the reference for light isotropy shifts as matter receives, and subsequently, retransmits a light ray. Ballistic theory #2 states that this shift occurs only when a light ray comes into contact with a solid or liquid piece of matter, such as the beam splitter or fully reflecting mirrors, in the case of the Michelson Morley Experiment. Ballistic Theory #3 proclaims that this shift can occur at the molecular level in a gas as well, including the nearly vacant gas of outer space.

Ether Theory #1 and #2 state that light will travel isotropic to some Hypothetical Ether. This Ether serves as the reference frame with respect to which the light travels isotropic.

Ether Theory #1 states that the hypothetical ether remains at rest to the fixed stars at all points in space. Ether Theory #2 states that the Ether is not stationary at all points in space. Rather, the ether gets dragged by matter.

The Special Theory of relativity states that light travels isotropic to the observer.

**3. The Six Theories of Light Isotropy-Summary of the Results**

BT=Ballistic Theory
ET=Ether Theory
SRT=The Special Theory of Relativity

BT #1-the original source
BT #2-shift occurs at liquids/solids
BT #3-shift occurs even in gas
ET #1-stationary ether fixed to stars
ET #2-entrained ether dragged by matter
SRT-observer

**4. The Michelson Morley Experiment-Description**

An interferometer usually consists of a monochromatic light source, one half silvered mirror, two or more fully reflecting mirrors, and a detector screen. The light originates at the monochromatic light source. It is sent towards the half silvered mirror. At the half silvered mirror, the single ray of light splits into two rays. These two rays proceed to travel along paths which are perpendicular to one another.

These two rays then hit a fully reflecting mirror (or set of fully reflecting mirrors) where turn around and then come back along the same path. When the two rays hit the half silvered mirror on their way back, they recombine into one ray. This ray then proceeds toward a detector screen. By examining the interference at the detector, the experimenters can figure out by how much the two rays are out of phase.

The interferometer can credit its accuracy to its ability to capitalize on the wave nature of light. The key component in the interferometer is the half silvered mirror, or beam splitter. To my knowledge, the half silvered mirror was invented only a couple of years before Michelson made use of it by inventing the interferometer in 1880.

Let us say that the two perpendicular paths that the two rays travel in are equal in length. In such a case, if it is assumed that the light travels at the same speed in each direction, then it is expected that the two rays will recombine in phase. However, if it is assumed that the light does not travel at the same speed in each direction, then it is expected that the two rays will usually combine out of phase. More specifically, if it is assumed that the light does not travel at the same speed in each direction, then it is expected that the two rays will recombine in phase only when one ray returns an integral number of wavelengths ahead of the other ray.

Michelson performed this experiment first in 1881, and then, with the help of Morley, in 1887. The interferometer was placed at rest on the surface of the earth. Each time Michelson found that the two rays recombined in phase (or approximately in phase) no matter which direction the apparatus was pointed in. This is called the null result.

The null result confirms the fact that light traveling near the surface of the earth will travel isotropic to the earth.

**5. Stellar Aberration Phenomenon-Description**

The phenomenon of Stellar Aberration is a non-terrestrial Experiment. It reveals to us how light travels when it travels from a star to earth.

Stellar Aberration revealed that light traveling from a star travels isotropic to the star. The best way to describe this phenomenon is by considering an analogous mechanical situation. Let us consider what would happen if it was raining, and we were running in the rain, and we had a hollow tube, and we wanted to get hit in the eye by the rain.

If we were running, we would have to point the tube somewhere in between vertical and horizontal. We would have to tilt the tube slightly from vertical in the direction that we were running in. If the tube was pointed vertically, straight up at the cloud, any raindrops entering the tube would hit the inner back wall of the tube before hitting our eye (depending, of course, on how quickly the raindrops were falling, how fast we were running, and how large the hollow tube was).

The phenomenon of Stellar Aberration reveals to us that the telescope has this back-wall effect in that to catch a ray of light, dropping from a star to our solar system, while we are traveling around the solar system, we have to point the telescope a little forward (in the direction of motion of the earth in our solar system).

**6. The Agreement of the Six Theories with the Michelson Morley Experiment**
(Beckmann, Introduction)

The Michelson Morley Experiment was a terrestrial experiment dealing with the velocity of light when it travels near the surface of the earth. Ultimately, the null result of the experiment verified that the light traveled at c with respect to the earth.

The light source used in this experiment was a laser. This experiment agrees with Ballistic Theory #1 because the laser remained at rest to the earth.

The laser, the beam splitter, the fully reflecting mirrors, and the detector are the only solids/liquids in this experiment. This experiment agrees with Ballistic Theory #2 because the beam splitter and fully reflecting mirrors remained at rest to earth.

The additional molecules in this experiment, besides those in the solids/liquids mentioned above, are the molecules in the air. This experiment agrees with Ballistic Theory #3 all the molecules remained at rest to earth.

Ether Theory #2 presumed that the Ether would be dragged by the earth, and therefore, at rest to the earth near the surface of the earth. This experiment agrees with Ether Theory #2 because the presumed Ether remained at rest to the earth.

The observers, Michelson and Morley, remained at rest to the earth during the course of the experiment. This experiment agrees with SRT because the observers, Michelson and Morley, remained at rest to the earth.

Hence, out of six potential theories, we have five of the six that agree with the experiment, without reconciliation.

Ether Theory #1 presumed an Ether that did not remain at rest to the earth. This experiment disagrees with Ether Theory #1 because the Ether was not presumed to remain at rest to the earth.

Disagreement of a theory with experiment ordinarily warrants abandonment of the theory. However, Lorentz and Fitzgerald liked Ether Theory #1 very much. Rather than abandoning it and picking another of the available theories, they sought to save the theory from death.

They had two choices: They could have (1) claimed that the Michelson Morley result was in error, or (2) reconcile Ether Theory #1 with the null result of the experiment. Lorentz and Fitzgerald knew that Michelson and Morley were capable experimentalists, so they sought to pursue option (2).

To reconcile the theory, they each, independently of one another, proposed that an amendment to the Ether Theory #1 was in order. Specifically, they proposed that matter contracts in its direction of motion through the ether. The amount of contraction they proposed was just enough to offset the otherwise predicted additional time of travel for the pulse of light traveling out and back along the direction of motion through the ether.

In total, there are six theories. Five of them agree with the Michelson Morley null result and remain standing without reconciliation. But one of them (Ether Theory #1) disagrees with the null result found in the Michelson Morley Experiment. Lorentz and Fitzgerald proposed contraction of matter moving through their Ether as a means of reconciling Ether Theory #1 with the Michelson Morley null result*.

---

*It should be noted that within the context of SRT there is no space contraction going on here. Spatial contraction of the apparatus would only be observed by Michelson and Morley if they were chosen to move with respect to the apparatus.

---

## 7. The Agreement of the Six Theories with the Phenomenon of Stellar Aberration

As mentioned, Stellar Aberration reveals that light travels through outer space isotropic to the star.

The light source used in this experiment is the star. Ballistic Theory #1 agrees with this experiment because the light travels isotropic to the source-the star.

There is no solid or liquid present in this experiment to influence the motion of the light ray (Airy's experiment not considered in this paper). Hence it follows that Ballistic Theory #2 predicts that the light will remain traveling isotropic to the source star. Ballistic Theory #2 agrees with this experiment because the light travels isotropic to the source-the star.

Ballistic Theory #3 predicts that the light ray will remain traveling isotropic to the star in outer space, but that the isotropy of light will change to that of our atmosphere once it enters our atmosphere. This can be likened to the fact that Ballistic Theory #3 predicts refraction (though nominal) to be experienced by the light ray at the interface of outer space and our atmosphere. Since the predicted refraction is nominal (less than one second of arc), Ballistic Theory #3 predicts that the light will continue traveling isotropic to the star, even after entering the earth's atmosphere. Ballistic Theory #3 agrees with this experiment because the light travels isotropic to the source-the star. (See Note at end of paper for greater details).

Ether Theory #1 predicts that the ether will remain at rest to the star. Ether Theory #1 agrees with the experiment because the light rays traveled isotropic to the presumed ether.

Ether Theory #2 predicts that the ether will remain at rest to the star in outer space but that the ether is entrained by the earth near the earth. Since the journey of the ray of light is much longer in outer space than it is near the earth, the isotropy of light encountered during the outer space travel will overshadow the isotropy of light encountered by the light ray in the earth's atmosphere, and the phenomenon of Stellar Aberration will still be picked up. The Ether Theory #2 agrees with this experiment because the light travels isotropic to the star during most of its journey.

Hence, out of six potential theories, we have five of the six that agree with the experiment, without reconciliation.

SRT predicts that al light observed by Bradley will remain traveling isotropic to Bradley (the earth). This experiment disagrees with SRT because the experiment showed that the light travels isotropic to the star-not the earth.

Disagreement of a theory with experiment ordinarily warrants abandonment of the theory. However, Einstein liked SRT very much. Rather than abandoning it and picking another of the available theories, he sought to save the theory from death.

He had two choices: He could have (1) claimed that the Bradley Stellar Aberration result was in error, or (2) reconcile SRT with the phenomenon. Einstein knew that Bradley was a capable experimentalist and theoretician, so he sought to pursue option (2).

To reconcile the theory, he somehow derived the formula for Stellar Aberration in his 1905 paper. This derivation stands as evidence for the assertion that the phenomenon of Stellar Aberration agrees with the assumptions of his theory, even though it apparently does not. In other words, it stands as evidence for the assertion that the apparent discrepancy between his velocity-of-light assumption, on the one hand, and the phenomenon of Stellar Aberration, on the other, is only apparent.

In total, there are six theories. Five of them agree with the phenomenon of Stellar Aberration and remain standing without reconciliation. But one of them (SRT) disagrees with the phenomenon. Einstein somehow derived the Stellar Aberration formula in his 1905 paper as a means of reconciling SRT with this phenomenon*.

---

*It should be noted that the phenomenon of Stellar Aberration is most definitely not evidence for SRT, in spite of the fact that Einstein derived the Stellar Aberration formula in his 1905 paper. Rather, the derivation represents Einstein's attempt to salvage his theory from apparent disagreement with Stellar Aberration phenomenon. Stellar Aberration is, in fact, perhaps the most compelling evidence that exists against SRT.

---

## 8. The Agreement of the Six Theories with Experiment -Summary of the Results

BT=Ballistic Theory
ET=Ether Theory
SRT=Special Theory of Relativity

Michelson Morley Experiment agrees with:

BT #1-without reconciliation
BT #2-without reconciliation
BT #3-without reconciliation
ET #2-without reconciliation
SRT-without reconciliation
ET #1-with reconciliation*

Stellar Aberration agrees with:

BT #1-without reconciliation
BT #2-without reconciliation
BT #3-without reconciliation
ET #1-without reconciliation
ET #2-without reconciliation
SRT-with reconciliation*

---

*The author finds it unfortunate that SRT and ET #1, the only two theories which require reconciliation at this point, are the two most commonly accepted theories. To see further scrutiny of the non-reconciling theories (i.e. BT #1, BT #2, BT #3, ET #2) under the widened scope of greater experiments (i.e. Airy, De Sitter), see Alford, Future Considerations-After SRT is Ruled Out.

---

## 9. Conclusion

As is seen in this paper, there are six potential theories which attempt to assert what it is that light travels isotropic to, when it travels through empty space. After consideration of the two most popular experiments, it is found that only four of the six remain standing, without reconciliation. As we progress from SRT to new theories regarding light isotropy, these four theories should be explored in the face of additional experimental evidence (Alford, Future Considerations-After SRT is Ruled Out).

### 10. Notes to the Various Sections:

#### 10.1 Introduction-Notes

---

Note 1: This paper considers exclusively Bradley Stellar Aberration (not Airy Stellar Aberration) and the original Michelson Morley experiments of 1881 and 1887. No other experiments are considered.

**----------**

Note 2: This paper is about the isotropy of light through empty space; not (1) what is the character of light, or (2) what is the velocity of light?

(1) the character of light

Current scientists automatically associate the character of light (wave or corpuscle) with the theories over the geometry of light (ether and ballistic, respectively). For further explanation of this point, and the problems inherent with automatically making this association, see the appendix.

(2) the velocity of light

The question of light isotropy is this: With respect to what does light travel isotropic? Let us say that we find that light travels isotropic to some observer or reference frame (i.e. conventional interpretation). The question of light velocity is now this: What is the velocity of light with respect to this observer or reference frame?

The first question is trying to find a frame of reference. The second question is trying to find the velocity of something within this frame of reference. The first question has a variety of answers and is unknown because we cannot interpret the experiments correctly. But we know that the speed of light is very close to the speed of c.

The velocity of light question is a matter of refinement and developing more accurate experiments. The isotropy of light question is a matter of interpreting correctly the data that we already have. The velocity of light is measured by different means than is the isotropy of light.

**10.2 The Six Theories of Light Isotropy-Description-Notes**

---

Note 1: Note that for some of these theories, the isotropic nature of a particular ray of light depends on location in space. For others, it does not.

Specifically, the isotropy of light does not depend on location in space for Ballistic Theory #1, for Ether Theory #1, or for SRT. The Ballistic Theory #1 says that the light will travel isotropic to the original source no matter where the light ray is. The Ether Theory #1 says that the isotropy of the light will remain traveling isotropic to the absolute frame of reference of the stationary ether, no matter where the ray is. SRT states that the light will remain traveling isotropic to the observer, no matter where the ray is.

The Ballistic Theories #2 and #3 predict that the sources will continue to dictate the isotropy of light, throughout the journey of any given ray of light. However, The Ballistic Theories #2 and #3 predict that the reference for isotropy of light will shift as the “torch” is passed, for any given ray of light.

The Ether Theory #2 predicts that the ether (or set of ethers) will continue to dictate the isotropy of light, throughout the journey of any given ray of light. However, the Ether theory #2 predicts that the reference for isotropy of light will shift as a ray of light enters regions of space where the ether is moving differently.

When examining the experiments on light isotropy, the predicted variation in light isotropy, as according to the three theories mentioned above (Ballistic Theories #2 and #3, Ether Theory #2), as a given ray of light transfers from one point in space to another point in space, needs to be taken into account.

---

Note 2: In our above descriptions, we did not consider the logic used to create the theories. Let us briefly consider the logic here:

The ballistic theories emerge from the notion that it is a jiggled charge in an atom that is responsible for the creation of a ray of light. The electromagnetic wave equation is derived from Maxwell's two electrodynamic equations plus the initial condition of a juggled charge. It is believed that the light described by this electromagnetic wave equation is to be taken with respect to the jiggled charge, since the jiggled charge appears as an initial condition for the derivation of the wave. For further discussion on this point, please see my paper (Alford, Future Considerations-After SRT is ruled Out.).

The Ballistic Theory #1 emerges because it seems obvious that, at least for the period of time before it hits any other molecules, that light from an original source will travel isotropic to the source. It seems obvious, for example, that the light coming from a source star should remain traveling isotropic to the star at least to the point where the first molecule is touched.

The Ballistic Theory #1 goes further and states that light should even remain traveling isotropic to the original source, even after the light coincides with molecules. While it may seem logical that the retransmission of light by the molecules in a gas has no effect on the velocity of light, it seems ludicrous to assume that the light remains traveling isotropic to the original source when it comes into contact with a liquid or solid. And it is.

After all, we know that light reflects and refracts. We know that light travels faster in a gas than in a liquid or solid. Such is the reason for the emergence of Ballistic Theory #2, which states that the isotropy for light can and does shift when the light enters a solid or liquid medium.

Ballistic Theory #3 carries this qualification of light to the limit, asserting that such a shift actually occurs at every point in space where a ray of light is absorbed and retransmitted by a molecule. According to this theory, the molecule could be in any gas, including the nearly vacated gas of outer space.

The Ballistic theories are also asserted from carrying over mechanical phenomenon to the electrodynamic domain. See the Appendix for greater discussion on this line of logic.

The ether theories are commonly postulated to account for the fact that light travels in the form of a wave. It is argued that the character of wave implies a medium present to carry such wave. See appendix.

Ether Theory #1 postulates that this Ether is stationary throughout the entire universe. Surely it wouldn't be the case that this Ether just "happened" to coincidentally coincide with the earths motion around the sun. It seems more likely that the ether would be glued to the motion of the sun itself. Or better, the fixed stars. Or even best, the center of mass of the universe.

Rationale for the development of Ether Theory #2 as a replacement of Ether Theory #1 is primarily related to the following two things: 1) alleged evidence against Ether Theory #1 (The Michelson Morley experiment) and 2) it seems reasonable to assume, that the motion of mass would carry this ether with it.

The reason for Einstein's assumption about light isotropy is because it follows from two postulates, taken together. According to Einstein, these postulates, themselves, appear logical. See my paper for further discussion (Alford, Einstein's Two Postulates).

---

Note 3: R.R. Traill has also noted a need to categorize the theories of light isotropy. In his paper "An Epistemological Re-assessment of Einstein's Special Relativity Theory, and of the Conceivable Alternatives to It", section 1.2, paragraph 4, he states "…in formulating any such theories, we must be quite explicit as to whether the chosen standard is to apply throughout the signals journey…". Such is the reason for my subdivision of the Ballistic theory into three types. Traill proceeds to provide a list of alternate theories for light isotropy, as follows (section 1.4):

(0) Some arbitrary object (other than source or observer) as standard.
(1) The *source* of the light constitutes the standard for its velocity.
(2) The *destination* (observer or measuring instrument) constitutes the standard.
(3A) The standard is some absolute "ether" unperturbed by matter passing through it.

(3B) The standard is an ether which is dragged by moving matter according to Fresnel's "drag coefficient" (Fresnel, 1818, Stokes, 1846).
(3C) The Standard is an ether which is dragged by matter, but according to some other formulation – (especially cases in which the drag *exceeds* the Fresnel/Stokes value).
(4)The standard is some unspecified summation of field influences emanating from surrounding (and perhaps remote) matter. (E.g. a summation of the velocity vectors for the surrounding matter, weighted according to its mass and proximity, and subject to an appropriate delay factor).
(5) The standard is whatever attenuated gaseous medium the light happens to be passing through, this being considered as an ordinary optical medium, presumably like glass.
(6) The standard is "empty space" – assuming that this assertion has some meaning.
(7) A hybrid: some weighted average of the above "(0…(6)".

Traill's list is slightly more comprehensive than the list proposed in this paper. This paper does not propose (0), (4), (6) or (7). Trail's theories (3B) and (3C) are not separated in this paper and are under ET #2. (5) is the equivalent of BT #3.

---

Note 4: More on the logic used to create the ballistic theory #3.

Maxwell derived the electromagnetic wave equation from his two electrodynamic equations, plus an initial condition. The initial condition concerns the process through which the electromagnetic field is generated. It is either assumed a) that a charge is jiggled or b) that an electric field is caused to vibrate. These two initial conditions are really the same because one will not obtain a vibrating electric field without jiggling a charge. Ultimately, a generated electromagnetic field can be traced to a source jiggled charge. For a derivation of the electromagnetic field from this initial condition, see Young and Freedman, pgs 1028-1034; Hecht, pgs 42-46, or Fowler, Lecture 14, "Wave Equations". Compare this with the ordinary derivation of a wave (Young and Freedman, Hecht, pgs 14-5; Fowler, Lecture 20, "Classical Wave Equations").

Since the derivation of the wave equation follows from this initial condition, it is postulated that the speed c referred to in the electromagnetic equation is to be taken with respect to the source jiggled charge. Assume that a molecule is disturbed. A charge will jiggle in molecule A and this jiggled charge will generate a light wave, traveling isotropic to molecule A. Light will travel isotropic to the molecule A until it comes into contact with a second molecule B. A short period of time will elapse for the molecule B to absorb and reemit the light wave. When it is reemitted, we have a new jiggled charge and therefore a new initial condition. The new wave front will travel isotropic to molecule B, and so on.

---

Note 5: Information contained in the Permittivity of Free Space-an apparent paradox

In most textbooks, when displaying all four of Maxwell's equations, the constants of permittivity and permeability are shown to be in Ampere's law. However, the constant of permittivity appeared in Coulomb's/Gauss' law, when we looked at those equations taken individually. Why did it disappear, and reappear in another equation?

The reason has to do with the fact that Maxwell's equations must be viewed collectively. The constant of permittivity got shifted from Gauss' law to Ampere's law to that it could reappear in electromagnetic wave equation. Maxwell derived the wave equation from the two electrodynamic equations. The electrodynamic equation provides us with c, in terms of the constants of permittivity and permeability. Hence it is found that the constants of permittivity and permeability contain all the information about the velocity of light.

As mentioned, Maxwell's four equations contain once the constant of permittivity and once the constant of permeability. Maxwell's equations, in turn, resulted from the experiments dealing with magnets and conductors. It follows that these magnet and conductor experiments, in and of themselves, provide us with all of the information about the velocity of light.

But the magnet and conductor experiments are not experiments which measure the velocity of light. They are experiments which identify the relative motion of charges (or electric and magnetic fields), without

respect to the retardation of light signals between such charges. That is, these experiments do not take into account the retardation of lights which occurs between the between the magnet and the conductor. Ritz takes this to indicate that Maxwell's equations imply advanced potentials.

So how then do these experiments which apparently don't account for the velocity of light manage to produce an equation which does. The answer to this question lies in the fact that it is only apparent that Ampere's law and Faraday's law provide alternative explanations to the same phenomenon (contrary to Einstein's interpretation). It is actually a different phenomenon and it has a domino effect.

The domino effect can actually be better understood by looking at the simpler right hand rule equations. A moving charge creates a magnetic field. This newly appearing (changing) magnetic field creates an (changing) electric field. This changing electric field creates another changing magnetic field, and so on.

While there may or may not be some redundancy between the laws of electrostatics and the laws of electrodynamics, there is no redundancy between Ampere's law and Faraday's law. They each only tell half of the story. Considering the above, it is more understandable to see how the velocity of light can be obtained from simple magnet and conductor experiments which, when independently considered, do not account for the velocity of light.

It may be instructive to note that the constants of permittivity and permeability can be more accurately determined via direct measurements of the velocity of light.
---

**10. 3 The Six Theories of Light Isotropy-Summary of the Results-Notes**
No notes

**10.4 The Michelson Morley Experiment-Description-Notes**

**----------**
Note 1: Ether Theory #1 assumes that the Ether remains at rest to the fixed stars. The sun travels at about 2 km/sec with respect to the fixed stars. The earth travels around the sun at about 29 km/sec (plus or minus 1 km/sec for rotation). So the Michelson Morley apparatus was traveling at about 29 km/sec (plus or minus 3 km/sec) with respect to the presumed ether.

Michelson and Morley estimated that their experiment could pick up the reference frame for isotropy of light to about a few km/sec. Hence they would be able to pick up the revolution of the earth but not the rotation of the earth. Brillet and Hall performed an interferometer experiment with improved precision, to the extent that they claimed that they could even pick up the earth's rotation.
---
Note 2: Proposed Experiments-Non-Terrestrial Interferometer Experiments

A Michelson Morley type interferometer should be placed on the outside of a space shuttle, and the Michelson Morley test should be rerun at different locations throughout our solar system. This helps to tell us about the isotropy of light at different locations throughout our solar system. So far, we only know about the isotropy of light here on earth (i.e. terrestrial interferometer experiments) , and the isotropy of light in deep outer space from the stars (i.e. Stellar Aberration).
---

**10.5 Stellar Aberration Phenomenon-Description-Notes**

---
Note 1: Initially, Bradley was studying a star called Gamma Draconis. He noticed deviations in his readings that could not be explained on the basis of parallax. He was led to assume the phenomenon of aberration through his study of several stars (not just Gamma Draconis).

Let us assume that a star is directly overhead. Normally, the telescope should be pointed in the complete vertical direction to catch the starlight. However, the telescope must be directed slightly forward in the direction of motion of the earth with respect to the star.

Specifically, assume that a triangle is defined by the components of motion of the light ray. We assume that the velocity of light, c, represents the length of the hypotenuse vector. We assume that the velocity of Bradley's telescope with respect to the star (29 km/sec plus or minus 3 km/sec), represents the length of the vector on the opposite side of the triangle. The inverse of the sine of 30 km/sec, divided by c, is about 20 seconds of arc.

The angle of tilt Bradley theorized and experimentally confirmed for the star Gamma Draconis was about 20 seconds of arc. Bradley could measure the angle of his telescope to the vertical to within about 1 second of arc.

Historically speaking, the phenomenon of Aberration was arrived at this way. Bradley could not explain his telescopic readings, that occurred over the course of a year, without assuming that the actual location of the star was 20 seconds of arc opposite to the direction of motion of the telescope with respect to the star.

A list of sources for information on the 1728 Stellar Aberration Phenomenon is given at the end of this paper.

---

Note 2: Qualification to this Paper-Stellar Aberration can only be inferred from Multiple Observations

In this paper, we consider Stellar Aberration from the point of view that the ray of light under investigation is observed on the night that the earth trajectory in our solar system is examined when it should be found that the star is directly overhead-straight above the earth. This is the night that the trajectory of the earth should be perpendicular to the trajectory of the ray of light coming from the star.

To be sure, the data on a star from a single night won't tell us anything about the phenomenon of Stellar Aberration, because the isolated data from a single night won't provide any basis for knowing where the stars are in the sky, other than where we are pointing our telescope in. Rather, the phenomenon of Stellar Aberration is an inferred characteristic of light propagation based on a set of data of the observation of a single star throughout the course of the year, and an assumption from such data on where the star really is. To the extent of this paper, we consider only the data from a single night of observation, and we assume it is known where the star really is.

---

Note 3: Proposed Experiments-Use of the Hubble Telescope and Comparison Readings

If this hasn't been done already, Stellar Aberration should be reperformed with the Hubble telescope. This would serve two purposes: 1) It would allow us to obtain greater accuracy of the readings, simply because it is easier to measure the angle of the Hubble telescope with the earth than it is to measure the angle of a telescope on earth to the earth (Imagine a laser pointing down from the Hubble telescope to the earths surface and revealing its angle), 2) It would allow us to compare the results with those made by telescopes on earth. This, in turn, would help to reveal whether or not there is any difference due to the effect of the earth's atmosphere on the traveling light rays.

Except for the comparison purposes as described above, all future Stellar Aberration data should come from the Hubble telescope. The reason twofold: 1) when examined from a telescope on earth, variables are introduced. We want to keep these variables to a minimum when studying Stellar Aberration, unless we're exploring an effect beyond Stellar Aberration. We especially do not want to introduce these external variables when exploring DeSitter Double Star Light Extinction. 2) The Hubble telescope should provide for more accurate readings of the angle which the telescope makes with the (see above).

Besides comparing the data between the Hubble telescope and a telescope on earth, for a given star, Stellar Aberration data should be compared between close double-stars and distant double-stars. This helps to provide information as to whether or not the light interacts with itself during the journey, and to what

extent. It helps to tell us how long the light must travel before it interacts with itself. This information is critical to the advancement of the extinction theory of light. (Alford, Future Considerations-After SRT is Ruled Out)

---

**10.6 The Agreement of the Six Theories with the Michelson Morley Experiment-Notes**

---

Note 1: The Hypothesis of Contraction

Instead of thinking of two rays of light traveling through an ether, we can think of two swimmers swimming through a river. The river is traveling downstream at the velocity of 30 km/sec. The swimmers can swim at the speed of c in still water. The river is a distance of, say, 100 yards across. The swimmers are going to race one another. One swimmer has to swim upstream to a tree which is 100 yards upstream, turn around and then come back. The other swimmer has to swim across the stream to the other side, turn around and then come back. It is calculated that the swimmer swimming across the stream and back should win.

Let us consider this "hypothesis of contraction" for our two swimmers. Ether Theory #1 (without the "hypothesis of contraction") expects that the swimmer swimming across the river and back should win. But the "hypothesis of contraction" says that the river will contract in the upstream/downstream direction. Therefore, the swimmer swimming upstream and then back downstream does not have to quite travel 100 yards up and 100 yards back. Rather, since the river is contracted, he only has to swim, say, 90 yards up and 90 yards back. It is because this swimmer does not have to swim quite as far that the swimmers can now tie the race. The "hypothesis of contraction" was calculated so that the swimmers would precisely tie.

---

Note that the Lorentz's hypothesis of contraction assumes that masses contract in their direction of motion with respect to the ether. Einstein's SRT assumes that space contracts for a moving reference frame. The latter implies a mismatch between meters in one system with meters in another system. But Einstein's space contraction, and the Lorentz formalism, isn't required to explain the MM Experiment within the context of SRT. This is because Michelson and Morley were the observers. SRT states that light will travel isotropic to the observers, and hence, to Michelson Morley. This is precisely what the null result established, without reconciliation, for SRT. As stated by Einstein in his book Relativity, a space contraction would only have been observed by Michelson and Morley of they were placed at rest to the stationary ether (i.e. at rest to the sun and stars). In summary, from an earth vantage point, no spatial contraction is noticed (because the apparatus remained at rest to earth), but from an ether vantage point, a spatial contraction would occur (because then the apparatus would be moving at about 30 km/se).

In his paper "Herbert Dingle was Correct (Part VIII), section four, paragraph eight, Ricker states: "In both (Ether theory and SRT), the same result was viewed as capable as explaining the null result of the Michelson-Morley Experiment. A physical change in the apparatus." Ricker knows that SRT proposes spatial contraction, not merely physical contraction, but he is suggesting here that a contraction of the apparatus was necessary to reconcile SRT with the null result. This is not the case. No contraction is necessary because the observers, Michelson and Morley, remained at rest to the apparatus. The Michelson Morley Experiment merely showed that light travels isotropic to the earth, when it travels in the vicinity of the earth. Michelson and Morley, which were the observers, the apparatus, and the earth were all at rest to one another in this experiment.

---

**10.7 The Agreement of the Six Theories with the Phenomenon of Stellar Aberration-Notes**

---
Note 1: Stellar Aberration and Ballistic Theory #3

Light can be traced to a source jiggled charge in an atom. This charge will oscillate the length of the atom, which is about one angstrom. From these considerations, we can assume that a single ray of light will contain a set of oscillating electromagnetic fields whose cross-section is equal to one angstrom by one angstrom. In other words, I'm defining the cross-section of a single ray of light to be one angstrom by one angstrom.

When have a detector screen, or a telescope, we are catching a whole bunch of these rays, each which has a cross-section of one angstrom by one angstrom. I calculate that the volume of space of one angstrom by one angstrom by 10 light years, in outer space, contains one molecule. (One angstrom by one angstrom by 10 light years is equal to one cubic cm, and I assume that outer space contains one molecule per cubic cm. Fox states "It is difficult to give the value for the density of interstellar gas in our galaxy. However, it seems to be about one hydrogen atom/cm3." (Fox, pg 6)). I calculate that the volume of space of one angstrom by one angstrom by 500 km, in our atmosphere, contains about 100 billion molecules. This is 1 molecule each 5 mm., for the given one angstrom by one angstrom cross-section of space. What this tells me is that a single light ray from even the farthest stars don't hit more than about a 1000 (that's the max) molecules before entering our solar system, but they hit several molecules once they enter our atmosphere.

It is best to first consider the phenomenon of Stellar Aberration from the point of view of the Hubble telescope (simpler), and then consider next that Bradley got the same results here on earth (a little more complex). The latter becomes important when we wish to interpret the results of Stellar Aberration for Ballistic Theory #3. This is because, according to Ballistic Theory #3, the Ballistic Theory #3 predicts that the light will travel isotropic to the star until it reaches our atmosphere. Once it enters our atmosphere, it will begin traveling isotropic to the molecules in our atmosphere.

Upon first glance, it might not be known whether or not Ballistic Theory #3 agrees with Stellar Aberration. However, the fact that the light will be traveling isotropic to the earth, by the time it reaches Bradley's telescope, does not imply that the phenomenon of Stellar Aberration shouldn't be picked up. It should still be picked up because, for most of the journey, the light travels isotropic to the star.

Consider an analysis of the situation on the basis of the refractivity experienced by the ray of light as it enters our atmosphere. The assumptions that go into the Ballistic Theory #3 are the same as the assumptions that go into the predicted phenomenon of refractivity (i.e. that light will slow down in mediums of greater density and speed up in mediums of lesser density, at the interface of the two mediums).

The index of refraction of empty space is one. The index of refraction of air in our atmosphere is nominally above one. The index of refraction of outer space is even less nominally above one. Any potential refractive effects at the interface of outer space with the earth's atmosphere are nominal. Specifically, by nominal is meant that any refractive effects predicted are less than one second of arc.

Since the refractive effects at the interface are nominal, Ballistic Theory #3 predicts that even telescopes on earth will pick up the phenomenon of Stellar Aberration.
---

**10.8 The Agreement of the Six Theories with Experiment -Summary of the Results-Notes**

No notes.

**10.9 Conclusion-Notes**

No notes.

## 11. Appendix: On the Automatic Isotropy/Character of Light Linkage

In the beginning of SRT, Einstein's two postulates are combined to produce an assumption about the velocity of light, which states: Light travels through empty space at the constant velocity of c with respect to all inertial observers/reference frames. Einstein builds SRT around this velocity-of-light assumption.

As stated above, Einstein constructs his theory around an assumption concerning the geometry of light, when the light travels through empty space. Stated differently, Einstein's SRT starts off with an answer to the following question: When light travels through empty space, what does it travel isotropic to (Q1, below)?

Since Einstein's theory answers this question, Einstein's theory can rightly be compared to other theories that propose an alternative answer to this same question. There are primarily two such theories (emission and ether). When studying SRT, then, it is somewhat relevant to also take a look at the emission and ether theories, just to see what they can offer, which experiments they agree with, etc.

As noted below, the current scientific community automatically ties the emission theory with the corpuscular character of light, and the ether theory with the wave character of light. I consider the legitimacy of such linkage in two of my papers. This appendix serves as an introduction to these two papers. Allow me to clarify the problem.

There are two basic questions about light, and the experiments developed to yield answers to question Q1 are entirely different from the experiments developed to yield answers to question Q2. Here are the two basic questions about light:

Q1: With respect to what reference frame does light travel (through empty space) at the same speed in all directions? (question of light geometry)

A1a: The source ("emission"/"ballistic" theories).
A1b: The ether ("ether" theories)

Q2: What is the character of light when it travels through empty space? (question of light character)

A2a: Corpuscular character
A2b: Wave character.

If these two questions are considered mutually exclusive, there are four possibilities:

(1) source isotropy with corpuscular character,
(2) ether isotropy with wave character,
(3) source isotropy with wave character,
(4) ether isotropy with corpuscular character.

The current scientific community links permits possibilities (1) and (2), but forbids possibilities (3) and (4). In other words, the current scientific community automatically links source isotropy with corpuscular character, and ether isotropy with wave character.

In total the current scientific community permits only the following two options: (A) source isotropy/corpuscular character, and (B) ether isotropy/wave character. It is seen that isotropy is associated

with or linked to character, but is it the isotropy that implies the character, or is it the character that implies the isotropy? There are four possible implicit implications:

(1) source isotropy implies corpuscular character,
(2) ether isotropy implies wave character,
(3) corpuscular character implies source isotropy,
(4) wave character implies ether isotropy.

What is the motivating logic behind such implications?

(1) source isotropy implies corpuscular character

The phenomenon of an exploding grenade demonstrates that masses follow trajectories that are isotropic to the source. It follows that there should be a general law of nature (covering both mechanics as well as electrodynamics) that if something is traveling isotropic to the source (mass or field) , then that something has to be a corpuscle.

(2) ether isotropy implies wave character

The phenomenon of water waves demonstrates that mechanical waves follow trajectories that are isotropic to the medium. It follows that there should be a general law of nature (covering both mechanics as well as electrodynamics) that if something is traveling isotropic to the medium, then that something has to be a wave.

(3) corpuscular character implies source isotropy

The phenomenon of an exploding grenade demonstrates that masses follow trajectories that are isotropic to the source. It follows that there should be a general law of nature (covering both mechanics as well as electrodynamics) that if something is a corpuscle, then it has to be traveling isotropic to the source.

(4) wave character implies ether isotropy

The phenomenon of water waves demonstrates that mechanical waves follow trajectories that are isotropic to the medium. It follows that there should be a general law of nature (covering both mechanics as well as electrodynamics) that if something is a wave, then it has to be traveling isotropic to the medium.

But does this logic stand up? The logic formulates a basic law of nature, which covers mechanics as well as electrodynamics, but in the realm of electrodynamics it has not been proven whether or not such a law of nature is true. Can we blindly extend this law of nature from the context of mechanics to the context of electrodynamics?

In other words, as is seen, to formulate these general laws of nature, familiar examples within the context of mechanics are given. In mechanics, we know that masses travel through empty space isotropic to their source, and we know that waves travel through mediums isotropic to the medium, but we do not know how fields travel through empty space. Since the situation is electrodynamics is different, can we assume that the mechanical law of nature will still be valid?

I consider this question with regards to cases (1) and (2) in one of my papers (Alford, Propagation Geometry and Propagation Character-Two Issues or One Issue), and I consider this question with regards to (3) and (4) in another of my papers (Alford, Problems with the All-Pervading Ether Hypothesis). It is found

there that there is no basis for extending these laws of nature from the familiar domain of mechanics to the unfamiliar and experimentally unverifiable domain of electrodynamics.

**12. General Sources Consulted**


Alford, J. "Problems with the All-Pervading Ether Hypothesis". 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?", 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", http://www.wbabin.net/pprrel.htm, . Alternative explanations to Einstein's are explored.

Beckmann, P., Einstein Plus Two. Golem Press, Colorado, (1987) Relevant passage is the introduction in which he describes which theories rise and fall from MM Experiment.

Brillet A. and Hall J., "Improved Laser Test of the Isotropy of Space", Physical Review Letters, Volume 42, Number 9 (1979)

Einstein, A. Relativity, Methuen and Co, London (1920)

Fox, J. G. "Evidence against Emission Theories". American Journal of Physics, Volume 33, Number 1. A good source to consult to learn what is wrong and what is right with ballistic/emission theories.

Fowler, M. Various ("Wave Equations", Classical Wave Equations"), www.phys.virginia.edu/classes/252. Well written series of lectures devoted to the development of Quantum Mechanics. Relevant passages include classical wave equations, Maxwell's wave equation.

Hecht, E. Optics, 3rd Edition, Addison Wesley, New York, (1998)

Kelly, A, Challenging Modern Physics: Questioning Einstein's Relativity Theories, Brown Walker Press, Boca Raton, (2005) Well written account of most of the experiments to date which test the isotropy of light. Written for the layperson. Presents a new theory concerning the isotropy of light that presumably fits the data. However, non-speculative and very experimentally-based.

Ricker III, H. "Herbert Dingle was Correct, (part VIII)", http://www.wbabin.net/pprrel.htm

Traill, R. R. "An Epistemological Re-Assessment of Einstein's Special Relativity Theory, and the Conceivable Alternatives to It"., http://www.wbabin.net/pprrel.htm

Young, H. and Freedman, R., University Physics, 10th edition, Addison-Wesley New York (2000)


**13. References for Information on Basic 1728 Stellar Aberration**


Kelly, A., Challenging Modern Physics: Questioning Einstein's Relativity Theories, Brown Walker Press, Boca Raton, (2005) pgs. 86-88.

Miller, A., Albert Einstein's Special Theory of Relativity, Springer, New York, (1998) pgs. 14-15.

Whitney, C., “Aetherial Models, Real Measurables”, Physics Essays, Volume 1, Number 3, (1995) pgs. 398-399.

Whittaker, E., A History of the Theories of the Ether and Electricity, Volume I , Thomas Nelson and Sons, Ltd, New York, (1953); pgs. 94-5.