# The Detection of Ether

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**Dedicated to: Marit Olaug Liset**
**My wife of 31 years, and mother of**
**our seven children and grandmother**
**to our nine grandchildren.**

# Chapter 1

# Overview

"I do not know what I seem to the world, but to myself I appear to have been like a boy playing upon the seashore and diverting myself now and then finding a smoother pebble or prettier shell than ordinary, while the great ocean of truth lay before me all undiscovered."
Sir Isaac Newton (1642-1727)

## Introduction

Since the days of Sir Isaac Newton, there have been two basic theories that have attempted to answer the question: "What is light?" Is light a particle or is there some substance that fills the universe, and light is a wave or signal that travels through this substance, much like sound is a wave or signal that travels through the air? The problem in answering this question is that light has both very strong particle properties and light has very strong wave properties.

The particle theory of light is now called the "***photon theory***." This theory is that photon particles are created and destroyed by atoms when electrons change quantum levels. This is a simplistic view but is sufficient for now. The particle theory of light was the dominant theory of light on two occasions. Newton believed light was a particle, then called a corpuscle, and his theory held until the very early 1800s. Einstein believed light was a particle, now called the "photon," and his theory has been in force since 1924 and continues to be the dominant theory at the current time.

The wave theory of light is called the "***aether theory***" or more commonly the "***ether theory***." One reason for having two spellings is to differentiate the ether that fills the universe versus the gas that can be used to put people to sleep. The ether theory is that the universe is filled with small particles, which I call "***ethons***." Ether is considered a medium for light, meaning light is a "***signal***" or "***wave***" that travels through the medium of ether. The ether theory of light was in favor with the scientific community from the very early 1800s to 1924.

Some people believe in both ether and photons. For example, Einstein admitted that his General Theory of Relativity would not work without ether, but the ether of Einstein's general relativity is vastly different from the ether of Nikola Tesla and Albert Michelson, and will not be discussed in this book.

## Einstein's Approach

A person might wonder what Einstein's Special Theory of Relativity ("***SR***") has to do with the photon versus ether issue. Actually, the SR was designed to be a key part of Einstein's three-pronged attack on ether in 1905.

Ether, as believed in 1905, filled the universe and was stationary (i.e. not moving). This meant that ether formed a "***Universal Reference Frame***" or "***URF***." In other words, in 1905 our sun was considered totally "at rest" relative to the universe and our sun was considered totally "at rest" relative to ether. This meant that the ether itself was "at rest" relative to the universe and therefore constituted a URF. Einstein's Theory of Relativity tried to replace the URF of ether with the concept of "***Relative Reference Frames***" ("***RRF***"). The removal of a URF is exactly the same thing as a removal of ether. In the introduction to the SR paper, Einstein made this statement: "The introduction of a "luminiferous ether" will prove to be superfluous inasmuch as the view here to be developed will not require an "absolutely stationary space" provided with special properties, nor assign a velocity-vector to a point of the empty space in which electromagnetic processes take place." This first prong in the attempt to eliminate ether was called the first postulate of the SR.

Einstein's second attack on ether had to do with the speed of light. In the 1880s, Michelson and Morley had done an experiment to detect the ether by detecting variances in the "***speed of light***" caused by our earth's motion through the stationary ether, which was considered the medium for light. The experiment received a "null result," meaning they did not detect any variance in the speed of light. Einstein's second postulate in the SR was another attempt to dispense with ether. In this postulate he speculated that the speed of light was a constant to all observers. He used this postulate to explain the null result of the Michelson-Morley Interferometer experiment. By using the SR to explain the Michelson-Morley null result, there was no need for "***ether drag***" (which will be discussed in a moment) to explain the null result, thus opening the door to a particle nature of light.

Because both of the postulates of the SR were designed to dispense with ether, it is clear that the main purpose of the SR was to dispense with ether. Thus, the SR and the photon theory are heavily intertwined.

Einstein's third approach to dispensing with ether in 1905 was to use the "***particle nature of light***." In his paper on the Photoelectric Effect, he tried to use the particle nature of light to try and disprove the "***wave theory of light***," meaning he again tried to dispense with ether.

Einstein's three-pronged attack on ether in 1905 was supplemented by other experiments and other observations, such as the blackbody radiation formulas of

Plank. Nevertheless, the "particle theory of light," now called the photon theory, was not accepted until 1924. Einstein's Nobel Prize in 1921 was not awarded for his particle theory of light or for his SR, but rather it was awarded for the formulas he developed for the Photoelectric Effect.

While it is true that the particle theory of light is the dominant theory because of light's particle properties, it is also true that light has equally powerful wave properties. Thus, we cannot determine whether light is a particle or a wave by appealing to the particle or wave properties of light. Light has both properties.

## My Approach

In 1997, I designed several experiments to use the "***path of light***" to detect the expansion of the Big Bang. After months of frustration, it suddenly occurred to me that "ether drag" (which will be discussed in a moment) was literally interfering with my experiment. I did not detect the Big Bang, but I inadvertently detected "ether drag."

With this discovery in mind, I then set about to dissect the Hafele-Keating experiment, which was a key experiment in the proof of relativity. In the Hafele-Keating experiments four cesium atomic clocks were flown around the world, first eastbound, then westbound. They predicted and observed that the clocks recorded different "***actual times***" (compared to the "actual time" measured by a stationary atomic clock on the ground) when they were headed eastbound versus when they were headed westbound.

What I discovered in my analysis is that the "at rest" reference frame chosen by Hafele and Keating ("a nonrotating point high above the North Pole") creates a very definite coordinate system and that "ether drag" is the only possible substance, force or field that has this same coordinate system and could have caused resistance to the cesium atoms and thus could have caused the "actual time" changes to the atomic clocks. What is unique about ether drag is that it forms a "bubble" around the earth (i.e. ether drag) and ***this bubble does not rotate with the earth*** (i.e. it is nonrotating), a property which no other substance, force or field has.

With this in mind, just like Einstein had a three-pronged attack against ether, this book will have a three-pronged attack against both the SR and the photon theory.

The first five chapters of this book, including this chapter, will deal with the Hafele-Keating experiment and SR. For example, in the original SR of 1905, ***any*** object (i.e. any reference frame) in an experiment could be used as an "at rest" reference frame. By 1920 Einstein had personally changed this to say that ***none*** of the objects in an experiment could be used as an "at rest" reference frame.

He stated that ***only one*** "at rest" reference frame could be used, and it was the "centre of a rotating disc."

When Hafele and Keating did their experiment, their ***one and only*** "at rest" reference point was ***thousands of kilometers*** from any aspect of the experiment. I will show that long before the Hafele-Keating experiment, the first postulate of relativity had already been abandoned. I should also mention at this point that there have been two different experiments that have detected a URF, one of which is the Cosmic Microwave Background Radiation experiments.

But perhaps equally as important as Einstein's own dismissal of RRFs, is that an RRF does not require a "***cause***." In other words, an RRF is an "***apparent reference frame***," and as such does not require any causal factor, such as a substance, force or field. When the SR evolved from "apparent time" (i.e. the "apparent time" of an apparent reference frame) to the "actual time" changes Hafele and Keating measured with their atomic clocks, the scientific community failed to make the switch from an "apparent cause" to an "actual cause." Right now in physics the "actual time" changes in Hafele-Keating's atomic clocks have an "apparent cause," meaning an "imaginary cause." "Actual time" changes require an "actual cause**!**" The only substance, force or field that has the correct coordinate system, and could be the "actual cause" of the Hafele-Keating data, is ether drag.

Furthermore, the SR deals with an "at rest" reference frame that is thousands of kilometers from the experiment and could not have caused the "actual time" changes. Ether drag deals with a substance that comes into ***direct contact*** with the cesium atoms in the atomic clocks. My discussion of the H-K proves that the SR is really ether drag and this is my first prong.

Chapters 6 through 10 deal with my two experiments plus the experiments of Lunar Laser Ranging. All three of these experiments involve the "path of light." These three experiment result in several paradoxes that totally eliminate any possibility that light is a particle, meaning it is impossible that photons exist. This is my second prong.

After a chapter on the "particle nature of light" and ether, there is a chapter on whether it is theoretically possible that the "speed of light" can be a constant with the photon theory. The result of this chapter is a paradox that clearly demonstrates that Einstein's second postulate cannot possibly be valid. This is my third prong.

In short, Einstein dealt with the "particle nature of light," the "speed of light," and "relative reference frames" to dispense with the ether theory. I will deal mainly with the "path of light" and "ether drag" to prove that ether exists. Einstein dealt with non-causal postulates. I will deal with causal theories. I will ***not*** use the

"wave nature of light" as one of my evidences**!** It is not necessary. When all the dust settles, it will be very clear that ether and ether drag exist.

This chapter will be the first chapter to deal with the Hafele-Keating experiment. Because the Hafele-Keating experiment deals with the SR, it is first necessary to have a short lecture on simple astronomy to understand what the current feeling on the URF is. I will then have a short section of what "ether drag" is. After these two sections, I will start to discuss the Hafele-Keating experiment in detail. After this chapter, the next four chapters will dive into this subject in even more detail.

## The Universal Reference Frame - CMBR

It is currently believed that our ***solar system*** is moving though space at about 370 kps (kilometers per second). The velocity of our solar system (and thus our earth) is a net speed consisting of two major motions, and several minor motions. These are the two major motions of our solar system:
1) The velocity of our galaxy in the cosmos (with which our solar system is carried along) at 600 kps towards the Hydra-Centaurus supercluster or the Great Attractor, and
2) The velocity of our solar system in orbit around the center of our galaxy towards Deneb in the Cygnus constellation at 230 kps (i.e. the rotation velocity of our galaxy at our distance from the galactic "***barycenter***," meaning gravitational center of mass).

The net of all of the motions of our solar system is a 370 kps velocity towards the constellation Leo (or slightly below it) and away from the constellation Aquarius.[1,2,3] This net velocity was calculated based on variances in the (2.7 degree Kelvin) blackbody radiation per the COBE satellite, U2 spy planes, high altitude balloons, and even newer equipment. This blackbody radiation is called "Cosmic Microwave Background Radiation" ("***CMBR***"). To the best of my knowledge, the CMBR was first discovered in 1978.[1]

The CMBR creates a Universal Reference Frame ("***URF***"), or "***Absolute Reference Frame***" ("***ARF***") for the universe as we know it. It also creates an "Absolute Time Frame" ("***ATF***") for the universe. Consider this quote: "The data indicate that the earth's velocity is about 400 kps in the approximate direction of the constellation Leo. Even though the principle of relativity says that there is no preferred frame of reference, as the laws of physics look the same to all observers, there is nevertheless a way to determine our absolute velocity with respect to the universe!"[2]

The two major motions of our solar system are very linear, over the period of a few thousand years, hence our solar system is traveling in an extremely linear direction and at an extremely constant speed. Imaging walking on the perimeter

of a circle that has a radius of 25,000 light years, our sun's distance from the center of the Milky Way Galaxy**!**

The total motion of our planet earth is a little more complicated. Because we are orbiting the sun at an average velocity of 30 kps, and because we are carried with the solar system, our earth's average velocity in the universe is still 370 kps, but it ranges from 340 kps to 400 kps. Note that the constellation Leo is on our ecliptic plane (the 2D plane formed by our sun and our earth's orbit).

Prior to the late 1920s, when it was discovered that our universe is expanding, it was generally believed that our sun was stationary in the universe, and that our earth's total motion in space was only 30 kps, due solely to our orbit around the stationary sun. This figure was consistent with "***stellar aberration***" or "***annual aberration***," which is a small tilt of telescopes required by astronomers because of our earth's orbital velocity around the sun. For many decades prior to the 1920s it had been known that "***aberration of starlight***" (i.e. the amount of the required tilt) was a good way to estimate our orbital velocity around the sun. However, with our new knowledge of our total velocity in the universe (i.e. 370 kps instead of 30 kps), a new explanation for aberration of starlight was needed.

Astronomers now have a term for the aberration caused by our solar system's total motion in space, they call it "***secular aberration***." The U.S. Naval Observatory Multiyear Interactive Computer Almanac states in its glossary: "***aberration, secular***: the component of stellar aberration resulting from the essentially uniform rectilinear motion of the entire solar system in space. Secular aberration is usually disregarded."[4]

The reason secular aberration is usually disregarded is not because it doesn't exist, it does exist, but because it is so constant that it is virtually impossible to detect. It causes a shift in the entire celestial sphere, meaning the actual position of virtually every star is not where it appears to be because of secular aberration. But since we aren't traveling to any stars any time soon, no one seems to care. Since secular aberration is so uniform over the period of a few thousand years, it is now believed that the "***actual***" "***tilt of aberration***" (i.e. the velocity which determines the degree that telescopes need to be tilted) is based on our 370 kps total velocity, but that the "***observable***" tilt of aberration is based on the "***differential velocity***" of the earth towards the constellation Leo. The differential velocity of the earth is caused exclusively by our orbit around the sun (I am ignoring several minor issues not significant to this discussion).

## Ether Drag

In the 1880s, it was felt that our sun was stationary in the universe. Thus, the only motion of our earth in the universe, as they thought at the time, was our earth's orbital velocity around the sun at an average of 30 kps. In the 1880s the

ether was believed to exist throughout the universe (the particle theory of light was not accepted by the scientific community until 1924), and it was also felt that the ether was stationary in the universe. Since our earth was moving through this stationary ether at 30 kps, there should have been a 30 kps "ether wind" on the surface of the earth.

In other words, imagine an automobile traveling at 100 kph down a highway, when the air is motionless. The car's surface would experience a 100 kph "wind," even though the air is motionless. Similarly, if the earth were moving at 30 kps through the stationary ether, there would be a 30 kps "ether wind" on the surface of the earth. An experiment was designed by Michelson and Morley to detect the 30 kps ether wind by detecting variances in the speed of light.

(Note: Whether the earth was stationary and the ether was moving or whether the earth was moving and the ether was stationary does not matter, the relative motion of the earth and ether would cause a change in the speed of light, if measured on the earth.)

But they could not detect this ether wind. The null result of the Michelson-Morley Interferometer ("***MMI***")[5] had scientists scrambling for an explanation. This was perhaps the first major failure of the ether theory since it had been accepted earlier in that century. If scientists of the day had known that our actual velocity in the universe was 370 kps, they would have been even more astonished by the null result of the MMI**!**

There were several theories that were proposed to explain the null result, including the SR. Michelson (who himself was a Nobel Prize winner) rejected the SR and championed the "***ether drag***" theory. The "ether drag" theory, which was actually proposed as early as 1831,[6] is that there is a "balloon" or "sphere" of ether that surrounds the earth and is carried or dragged with the earth in its motion in the universe. This is actually a very logical theory. The earth's gravity can attract and hold very heavy air molecules (heavy compared to ethons), called our atmosphere, as it travels towards Leo. Thus it is logical to say that our gravity can also hold ethons, which are much lighter than air molecules. Just as our earth's gravity protects the air molecules from being attracted by the superior gravity of the sun, our earth's gravity would protect the ethons from the superior gravity of our sun.

Both Cauchy and Stokes believed in ether drag decades before the MMI.[6] The ether inside of this balloon is at rest and does not rotate with the earth according to Michelson's version of ether drag. In other words, the ether in the ether drag is stationary, or nearly stationary, and the earth rotates underneath the ether.

To understand ether drag consider this metaphor: Imagine a large beach ball sitting on a table. Suspended at the center of this large beach ball is a golf ball that is rotating on an axis. Since the air in the beach ball does not rotate with the

golf ball, a very small object (such as a dust particle) on the surface of the rotating golf ball would experience a small "wind." This wind would not be caused by the beach ball moving (it is sitting on a table), it would be caused by the surface of the golf ball being pushed through the stationary air, inside the beach ball, by the rotation of the golf ball. It is a very small "wind" to be sure, depending on how fast the golf ball is rotating. But even if the beach ball were moving (i.e. suppose it were attached to the top of a car traveling at 100 kph), the "wind" on the surface of the golf ball would be the same.

If the rotating golf ball represents the rotating earth, and if the stationary air inside of the beach ball represents ether, we have the model of ether drag championed by Albert Michelson. The golf ball rotates but the air inside the beach ball does not rotate with the golf ball. Similarly, the earth rotates but the ether in the ether drag (note. "the ether in the ether drag" will simply be referred to as the "ether drag") does not rotate with the earth.

In this model note that no part of the golf ball is stationary inside the beach ball except for the axis of the golf ball. The air above the golf ball, and the axis of the golf ball, are the items inside of the beach ball that are "at rest." The golf ball itself, except for its axis, is in motion relative to the sides of the beach ball, and relative to the air. Thus, any point on the extended axis of the rotating golf ball could be considered "at rest."

Without ether drag, the ether wind would be 370 kps on the surface of the earth. With ether drag, the earth would be totally shielded from this 370 kps ether wind (or even the 30 kps ether wind if the sun's ether drag extends beyond our orbit distance from the sun) and the only ether wind would be caused by the rotation of the earth at a maximum of 0.45 kps on the equator. At the North Pole, the South Pole, or anywhere on the extended axis of the earth, the ether wind would be zero.

The MMI equipment was not accurate enough to detect the ether wind with ether drag (i.e. 0.45 kps maximum), so in 1925 Michelson-Gale and Pearson, now assuming ether drag, designed a different experiment to detect the much smaller ether wind. This experiment was successful ***to within 2.5%*** of detecting the rotation velocity of the earth at their latitude.[7] However, by this time relativity had been established and their experiment was simply brushed off by the scientific community.[7]

## The Hafele and Keating Experiments

The Hafele-Keating experiments of 1971 are among the most famous experiments in the history of physics. Their experiments were designed to test the validity of Einstein's SR and his General Theory of Relativity ("***GR***"). Hafele and Keating twice flew four cesium atomic clocks around the world in commercial

jets, first eastbound, then westbound. Their experiments proved that "time," as measured by atomic clocks, is a function of the direction, velocity and altitude of jet airplanes. The direction and velocity of the airplanes were factors of the SR and the altitude of the jets was a factor of the GR.[8,9,10,11] I should note that "time" in this case is the "***actual time***" as measured by the atomic clocks.

Compared to the time kept by a stationary atomic clock at the U.S. Naval Observatory ("***USNO***"), which stayed on the ground, the eastbound clocks measured time ***slower*** than the stationary clock and the westbound clocks measured time ***faster*** than the stationary clock. Prior to their experiments, Hafele correctly predicted that the westbound clocks would measure time faster than the stationary clock.[8,9]

The Hafele-Keating experiment is considered a proof that the SR and GR are valid theories. But the H-K used a very different version of the SR than was proposed by Einstein in 1905.

For example, in the "***old SR***" of 1905, ***every*** element in the experiment was considered, or could be considered, an "at rest" relative reference frame. This was the entire intent of the concept of "relative reference frames." For example, if there were ten jet airplanes flying at ten different velocities in ten different directions, any one of these ten airplanes could be used as the "at rest" reference frame, for the formulas of relativity, to determine the "relative time" between it and any of the other planes.

By 1971, however, the concept of "relative reference frames" had been totally eliminated. In the "***new SR***," used by Hafele and Keating, ***none*** of the two sets of jet airplanes or atomic clocks in the experiment were allowed to be considered "at rest." Not even the stationary atomic clock at the USNO could be considered "at rest."

In the "new SR" used in the H-K, only ***one*** "at rest" reference frame was allowed and that was "a nonrotating observer looking down on the North pole from a great distance"[9] or to put it more simply: "a nonrotating point high above the North Pole." This "at rest" reference point was not part of the experiment, meaning there was no atomic clock at that point. The "at rest" point in the H-K was many thousands of kilometers from any of the atomic clocks that were part of the experiment**!** The entire concept of "relative reference frames" was that any object that was part of the experiment could be considered "at rest." No object in the experiment was ever considered "at rest" by Hafele and Keating.

It is important to emphasize that the observer or point is "nonrotating." If the observer rotated with the earth, then a stationary point on the equator, for example, would be viewed as being "at rest" relative to the observer's viewpoint. However, because the observer is not rotating, then a stationary point on the

equator would be moving at a velocity equal to the (angular) rotation velocity of the earth at that latitude (i.e. zero degrees north).

Thus, the "stationary" clock at the USNO was considered to be in motion due to the rotation of the earth (i.e. its velocity was measured relative to the rotation velocity of the earth at its latitude) because the observer was not rotating.[9] Thus, the "stationary" clock was actually in "motion."

Let's call a spade a spade. Hafele and Keating could be said to have used a "***local or localized Absolute Reference Frame ("local ARF") and a local or localized Absolute Time***." By "***absolute***" I mean that the "at rest" reference frame they chose was ***not part of the experiment*** and did not move (relative to other objects), and did not rotate, during the experiment. By "***local***" I mean that they did not use the URF of CMBR (which had not been discovered by 1971), or the reference frame of the sun's barycenter (which Hafele and Keating obviously would have known about), or the galactic barycenter (which they should have known about), but instead they used a reference frame within the ionosphere, which is "local" to the earth, meaning it travels with the earth in its motions in the universe.

The choice of an "at rest" reference frame thousands of kilometers from the experiment was clearly not the intent of the original SR, but was added by Einstein before or during 1920 when he started talking about the center of a rotating disc as the one and only allowable "at rest" reference point.[12] Einstein's change of mind from using "at rest" reference frames that were part of the experiment, to using a single local ARF that was thousands of kilometers from the objects in the experiment, was undoubtedly due to empirical data. Einstein was known to have been working on the Doppler effect of canal rays (a predecessor to today's atomic clocks) prior to 1908.[13] In fact, the 1919 Nobel Prize was awarded to Johannes Stark for the discovery of the Doppler effect in canal rays, which discovery was made by Stark in 1905.[14]

Hafele and Keating did not invent the concept of using an "at rest" reference frame on the extended axis of the earth, they knew what they had to use before they did their experiments. The two articles written by Hafele before the experiment prove that. They knew that if they used the stationary USNO atomic clock as their "at rest" reference point the formulas of the SR would not have worked with the actual data. Even before the H-K it was known that in order to get the formulas of the SR to work it was necessary to pick a localized ARF on the extended axis of the earth. It is probable that the reason Hafele and Keating used "a nonrotating point high above the North Pole," instead of the center of the earth, is because its use made it easier to visualize and explain why the stationary USNO atomic clock had to be in motion.

## The Goal of the SR

The main goal of the original SR was to replace the concept of URF or ARF with the concept of RRFs. In other words, its main goal was to replace the then dominant theory of ether (which represented a URF) with the particle theory of light. But the concept of RRF was ***dropped*** in the transition from the "old SR" to the "new SR" as is demonstrated by the fact that the H-K used only one local ARF, not the relative reference frames of the objects that were part of the experiment. Furthermore, a URF has been proven to exist by two vastly different experiments**!** Both the CMBR experiments, which are ongoing, and the experiments of Roland De Witte in 1991 have detected the URF.

The old or original SR dealt with "relative time" differences of the objects in the experiment, which basically meant "***imaginary times***." To understand why I use the term "imaginary times," suppose in the above ten jet example, you chose one of the ten jet airplanes as a "***target***." Suppose you then, simultaneously and independently, picked each of the other nine airplanes as the "at rest" reference frame and calculated the "relative time" of the "target" jet airplane, relative to each of the nine "at rest" reference frames. The "target" jet airplane would have nine different "relative times" simultaneously. This means that "relative time" is really "imaginary time," relative only to the chosen "***observer***" (i.e. "at rest" reference frame). The "actual time" of the "target" jet airplane would be ***different*** than any of the "imaginary times" of the other nine observers per the H-K**!** That is, unless one of the jets just happened to be "at rest" relative to the axis of the earth.

The concept of "relative time" evolved from being the "imaginary time" of the "old SR" to the "actual time" of the "new SR." In other words, the same term: "relative time," can be used for "imaginary time" or "actual time." This obviously causes ***a lot of confusion*****!** When the term "relative time" is used, the context must be studied.

Even Hafele and Keating were confused by this. They claimed that their experiment solved the clock paradox. As far as the "old SR" is concerned, their experiment was totally irrelevant to the clock paradox. The clock paradox was a paradox of the "imaginary time" of the "old SR." The clock paradox was resolved, not by solving the problems with the "old SR," but by dropping the "old SR" in favor of the "new SR," which used "actual time," not "imaginary time." By using the same term: "relative time" for ***both*** "imaginary time" and "actual time" the authors incorrectly thought they had solved the problems of the "old SR."

The "new SR" dealt with "actual time" differences, meaning the measurements of the atomic clocks were of "***actual*** time" changes of the clocks, not ***apparent*** or ***imaginary*** time changes. The "actual time" measured by atomic clocks changes as the jet airplane carrying the clocks speeds up, slows down, changes direction,

etc. This is profound. Because the H-K talks about "actual time" differences it must then deal with "***actual causes***" of those actual time changes.

To be more specific, nothing needs to be mentioned to cause "imaginary time" changes, because they are ***imaginary***, thus the ***cause*** is ***imaginary***. However, something ***actual*** (i.e. a substance, force or field) ***must cause*** "actual time" changes**!** Neither the "old SR," nor the "new SR" officially offer any such causal explanation. In other words, ***the concept of "relative time" changed from "imaginary time" to "actual time," but the SR failed to make the change from an "imaginary cause" to an "actual cause."*** This is why the scientific community thinks that an "***imaginary cause***" can generate "***actual time***" changes in atomic clocks**!**

In reality, the ten jet airplanes in the above metaphor do experience ten different "actual time" changes. The H-K proves that. The flaw in the old SR is in allowing ***any*** of the ten jet airplanes to be considered "at rest." This leads to paradoxical and conflicting "imaginary time" differences and even ***incorrect predictions*** of "actual time." Because the H-K used the correct "at rest" reference frame (which was thousands of kilometers from any of the jets or USNO) for all of the atomic clocks, they did fix that part of the SR. And as will be seen later in this book, the "actual time" differences between any two of the airplanes can be calculated, but it is a two step process, not a one step process as the old SR implies.

My point at this stage of the book is to emphasize that "actual time" changes require "actual causes." More will be said about this below.

## The Choice of the "At Rest" Reference Point

At the time of the experiments, both Hafele and Keating should have known that our solar system was rotating around the barycenter of our galaxy, and they would have known that our universe was expanding. But they would not have known about the CMBR, meaning they would not have known our earth's total velocity with respect to the universe. They undoubtedly also knew that Einstein had changed the "at rest" reference frame of the SR to be the center of a rotating disc. They had three nonrotating "at rest" options to choose from based on this new disc theory:

1) Our galactic barycenter, which our sun and earth are rotating around, or
2) The barycenter of our sun-centered solar system, which our earth is rotating around, or
3) A point on the axis of the earth, which the atomic clocks were rotating around.

In 1905, item #2 would have been the logical choice because our sun was considered stationary in the universe at the time, and thus item #2 would have been stationary with respect to the entire universe (i.e. it would have been

considered a URF). It would have been the perfect "at rest" reference frame. But relativity claimed there was no such thing as a URF. At the time, in 1905, the axis of the earth was ***not*** chosen as the "at rest" reference frame, because the axis of the earth was not part of any experiment.

(Note: In Einstein's original paper he coincidentally mentioned that an object on the equator would measure time differently than an object at the poles, however, this observation had nothing to do with the "new SR," it was part of the concept of "relative reference frames.")

In 1971, the logical choice for Hafele and Keating would have been item #1 above. Since they were not using an "at rest" reference frame that was part of the experiment, they should have been looking for the ***most*** "at rest" reference point they knew about. However, an argument over what they should have used is irrelevant because they knew in advance what they must use to get the formulas to work.

But let us consider another point. If an "at rest" reference frame can ***cause*** "actual time" changes, as the SR implies because the "at rest" reference frame is so prominent in the theory, note that there are three different "at rest" reference frames in the above list. If an "at rest" reference frame causes "actual time" changes, why didn't all three of the above "at rest" reference frames (plus CMBR) ***contribute*** to the "actual time" changes of the atomic clocks?

Or to put it another way: what is it about "a nonrotating point high above the North Pole" that ***protected*** and ***shielded*** the atomic clocks in the H-K from the "at rest" reference frame of the ARF of CMBR? Also, what is it that protected and shielded the atomic clocks in the H-K from the "at rest" reference frame of the galaxy's barycenter and the sun's barycenter?

In other words, if an "at rest" reference frame ***causes*** (or participates in the cause) atomic clocks to change their "actual times," then the center of the earth, the center of the sun, the center of our galaxy, ***and*** CMBR, would all affect and cause changes in the "actual time" of the atomic clocks in the H-K. But according to the H-K, only one of these "at rest" reference frames affected their data. So what is it about the axis of the earth that ***shields*** the atomic clocks from the other three "at rest" reference frames?

Obviously, an "at rest" reference point thousands of kilometers from an experiment cannot have caused "actual time" changes in atomic clocks. My point is that whatever physically caused the atomic clocks to speed up and slow down ***must*** be "**carried**" with the earth in its motion towards Leo and in its orbit around the sun and it must "***shield***" the atomic clocks from any extraterrestrial effects related to the universe, galaxy or solar system.

The "new SR" not only failed to deal with what ***caused*** the atomic clocks to change "actual times," it did not explain what ***shielded*** the atomic clocks from universal, galactic and solar system "at rest" effects or other effects.

## Why Relativity is Really Ether Drag

The SR transitioned from the URF created by ether, to RRFs, with the purpose in mind to dispense with the ether theory of light. In fact, the Lorentz Transformation, the key formula Einstein used in his SR, was developed by Hendrik Antoon Lorentz, who developed the formulas ***specifically*** for the use of objects moving in the ether**!** In other words, Einstein changed the name and interpretation of the Lorentz Transformation and used a formula designed for ether to disprove the existence of ether**!**

Now let's think about the earth rotating inside of this ether balloon. The only part of the earth that is not rotating, relative to the ether drag, is the extended imaginary axis of the earth (per the above beach ball/golf ball metaphor). The H-K used a point on the earth's extended imaginary axis as their one and only "at rest" coordinate system in the H-K. This point is "at rest" relative to the ether drag because the observer is not rotating. This means that the one and only "at rest" reference frame the H-K used was a point that was "at rest" ***relative to the ether drag*****!** This means that the H-K ***could have used*** ether drag as their sole coordinate system**!** In other words, Hafele and Keating used exactly the same coordinate system as ether drag creates**!**

It was noted above that the "new SR" does not have an explanation for the cause of time changes in the atomic clocks. Nor does the "new SR" have a theoretical explanation for the use of a localized ARF, instead of the CMBR or galactic barycenter or solar barycenter. Nor does the "new SR" have an explanation for what shields and protects the atomic clocks from the "at rest" reference frame of CMBR, the galactic barycenter, or our solar barycenter (i.e. extraterrestrial effects).

The ether drag theory easily explains these issues. Lorentz developed his formulas for the motion of objects relative to their ***ambient*** ether. With ether drag, our earth, and its time frame, are protected from the Absolute Time of the CMBR by the earth's ether drag. Thus, there is a logical reason why the ether drag theory creates a localized ARF for objects inside of the ether drag - they are protected from any phenomenon that are related to our total motion in space and even from our orbit around the sun and galaxy.

So how does ether cause "actual time" changes to atomic clocks? Because ethons are much smaller than atoms, ethons would cause resistance to the cesium atoms in the atomic clocks (much like air causes resistance to jet airplanes). Furthermore, the ethons, as part of ether drag, would have the

correct velocity relationship to the atomic clocks (i.e. the coordinate system created by ether drag is consistent with the H-K data). In other words, the amount of resistance caused by the ethons would be a function of the "***ambient velocity***" of the atomic clocks in the ether drag.

This is exactly what Lorentz had in mind with respect to ether when he developed the formulas for ether that Einstein borrowed for the SR. However, Lorentz probably did not believe in ether drag when he developed his formulas, thus he may never have known just how literally correct he had been**!**

Because the "new SR" deals with "actual time" changes, it is necessary to talk in more detail about causal agents.

## What is a Theory?

Since the terms "theory" and "postulate" are frequently used synonymously, let me provide definitions for these terms that clearly delineate between them.

A "***theory***" is a logical statement of beliefs as to the "***cause***" of "***why***" some physically measurable phenomenon occurs."

A "***postulate***" or "***assumption***" does ***not*** include a cause of why some physically measurable phenomenon occurs.

It is necessary for physics to have two definitions that clearly delineate between theories that have causes, and postulates that don't. Rather than invent new words, I will clarify the definitions of the above three words.

While a dictionary may use the terms "postulate", "assumption" and "theory" synonymously, it is critical that physicists make a clear distinction between two concepts: causal and non-causal. It would be a major roadblock to the progress of physics to think that a postulate or assumption (as I have defined them) has the same logical weight of a theory.[15] Understanding the cause of some phenomenon allows far greater visualization of what is going on and allows far greater progress.

The new SR states that "actual time" is a function of the velocity, direction and altitude of jet airplanes (with atomic clocks inside of them). But it offers absolutely no ***causal*** explanation for ***why*** "actual time" changes occur. According to my definition of "theory," the "Theory" of Relativity does not even contain a theory.

But this is not all. Some physicists today do not delineate between a formula and a theory. "Shut up and calculate" was a motto of Richard Feynman. But how does a formula tell us ***why*** some phenomenon happens? A formula has the

same problems for progress and understanding as a postulate or assumption does because none of these things project a cause as to why something happens, and something must ***cause*** "actual time" changes**!**

## What Causes Atomic Clocks to Speed Up and Slow Down?

Let us summarize exactly what properties the substance, force or field must have to generate the H-K data:

1) "Actual time" changes must be ***caused*** by some substance, force or field coming into ***direct contact*** with the cesium atoms in the atomic clocks. An "at rest" reference frame thousand of kilometers away will not suffice as a cause. Ether particles come into direct contact with the cesium atoms.

2) This contact must cause ***physical resistance*** (or electromagnetic resistance) to the atoms in the atomic clocks such that the eastbound jets have more resistance than the westbound jets as they fly through this substance, force or field. In other words the westbound jets must be flying ***in the same direction*** as the "wind" of this substance, force or field. Our earth rotates eastbound. But the ether drag does not rotate with the earth, thus the "ether wind" caused by the rotation of the earth is headed westbound. Thus the westbound clocks would be moving in the same direction as the ether wind, thus these clocks would experience less resistance, and faster actual time. The eastbound clocks would be flying directly into the ether wind and their time would slow down. More will be said about this in a moment.

3) All of the atomic clocks in the experiment must be protected from the effects of this same substance, force or field, coming from outside of our earth system. In other words, the "at rest" reference frame, relative to this substance, force for field, must not be affected by extraterrestrial effects of this substance, force or field. This means that the substance, force or field that causes resistance to the cesium atoms ***must form a "balloon" above the earth***, high above the jet airplanes, and the balloon must be carried with the earth, in order to protect the jet airplanes from any extraterrestrial effects of this ***same*** substance, force or field that exist outside of this balloon.

4) Also, the "stationary" atomic clock must be in motion relative to this substance, force or field, equal to the rotation velocity of the earth at its latitude.

5) Because the westbound jets must experience the least resistance, and because the stationary clock must be in motion relative to the rotation velocity of the earth, it must be concluded that ***the area between the surface of the earth, extending to above the altitude of the jets, must rotate underneath the balloon created by this substance***, such that the westbound clocks are traveling in the same direction as the "wind" of this substance, force or field and

the stationary clock is in motion. As just mentioned, the earth rotates eastbound, but the minimum resistance is for the westbound jets, thus the wind must head westbound**!** The only way for this to happen is if the balloon is stationary, and the earth rotates underneath this balloon.

## Summary of Things That Cannot Have Caused the H-K Data

To make sure there is no misunderstanding, let us itemize some of the items (as a representation of other items), that could ***not*** have caused the H-K data.

(Note: A discussion of potential extraterrestrial causes of the H-K data can be found in Chapter 5.)

1) The earth's magnetic field: Cannot be valid because it rotates with the earth, thus none of the atomic clocks would have had the right velocity relative to the earth's magnetic field. (Note: the atomic clocks in the H-K were "triply" shielded from magnetism.[11])

2) The earth's gravitational field (***including*** General Relativity): Same as the magnetic field - it rotates with the earth, etc. The world's record (the last I heard) for stacking bowling balls on top of each other is nine. This should be adequate proof that the stationary atomic clock would have been "at rest" relative to our earth's gravitational field.

3) Electromagnetic waves: These are random throughout the earth's surface. Furthermore, the stationary atomic clock would have been "at rest" relative to these waves.

4) Photons: First of all, photons do not shield the earth from extraterrestrial photons. Second, photons are random, thus the stationary atomic clock would have been "at rest." Third, since the only photons the cesium atoms would have been exposed to would be photons that originated inside of the atomic clock casings, even the traveling atomic clocks would have been "at rest" relative to photons.

I could mention other items, but it is clear that whatever caused the H-K data must form a bubble around the earth that does not rotate with the earth, and the bubble must travel with the earth towards Leo. This substance's bubble must also ***shield*** the earth from extraterrestrial effects. Nothing even comes close to ether drag for matching these criteria and matching the H-K coordinate system.

## Did the SR Prove That Ether Doesn't Exist?

In summary, the main goal of the SR was to do away with ether and its URF or ARF. Has it been successful? Consider:

1) The SR is a postulate and does not contain any suggestion of an "***actual cause***" of the H-K "***actual data***." The ether drag theory offers a logical "at rest" reference frame (ambient ether drag) and a logical causal agent (ethon resistance).

2) The SR used the concept of RRF to dispense with ether, but the RRF has been removed from the original SR and replaced with a localized ARF in the "new SR."

3) The SR dispensed with the concept of URF to dispense with ether, but a URF has been detected - in two vastly different experiments.

4) The H-K used a localized ARF "at rest' reference point that has the ***identical*** coordinate system as "ether drag." The SR uses an imaginary "at rest" reference frame, but the "ether drag" uses a substance for measuring "ambient velocity".

5) The SR contains formulas that were developed by Lorentz ***for*** objects in the ether and for the motion of these objects relative to their ambient ether. How can a successful formula that was devised for use in ambient ether be used as a disproof of ether?

6) In the "new SR," not even an atomic clock sitting on the ground is allowed to be considered "at rest," because the formulas won't work. In the "ether drag" theory, the stationary atomic clock is pushed through the ether by the rotation of the earth, thus the stationary atomic clock is in motion relative to its ambient ether.

7) The H-K used an "at rest" reference frame that is ***thousands of kilometers*** from any object in the experiment. This is a far different concept than the original SR, where only the objects in the experiment were considered "at rest." The ether drag theory uses a substance that comes into direct contact with the atoms in the atomic clocks.

8) Since the "at rest" reference point used in the H-K is part of the ***formulas*** of the SR, then it must be part of the ***physical cause*** of why actual time is a function of the velocity and direction of the atomic clocks. The axis of the earth is imaginary, and cannot cause cesium atoms thousands of kilometers away to speed up and slow down. Since ether drag technically deals with "ambient velocity," not "relative velocity," the "ambient velocity" is part of the formulas ***and***

is part of the physical cause of the clocks speeding up and slowing down (by changing resistance).

9) The relative resistance in the ambient ether causes the electrons to speed up and slow down because there is no mechanism in an atom to ***detect*** changes in resistance to the electrons in the atom and to ***adjust*** the energy given to the electrons to react to the different levels of resistance, in order to maintain a constant electron velocity. Thus, the electrons must slow down and speed up when the ambient resistance changes. Therefore, "actual time" must speed up and slow down.

10) Not even the "new SR" offers a theoretical reason why the "at rest" reference frame of CMBR is not used in their formulas. They offer no explanation of what "shields" the axis of the earth from the CMBR "at rest" reference frame or the "at rest" reference frame of the barycenter of the solar system or galaxy. But the localized ARF works with the formulas of ether drag and the ether drag theory explains why it works - ether drag protects and shields the atomic clocks from extraterrestrial effects.

If the reader has been paying attention, it should be ***obvious*** that the ether and ether drag theories need to be looked at ***seriously*** and in more detail. If it is not obvious, the reader should read the lists again until it is obvious.

The above items are simple facts. I haven't even gotten into many of the details of these issues - which is what this book is designed to do. It is totally absurd to consider the SR as a disproof of ether. How can a postulate, which does not contain a causal agent for actual time changes, which is constantly being changed, which uses a formula originally designed for ether, and which cannot justify the use of its own "at rest" reference frame, which is thousands of kilometers from the experiment, disprove the existence of a substance that can logically explain why things work the way they do?

## The Second Postulate of Relativity

The first postulate of the SR is basically that any reference frame can be considered to be "at rest," meaning it can be considered to be an independent RRF. As mentioned above, Einstein himself dispensed with this postulate when he chose to use only the "center of a rotating disc" as his local ARF and chose to deal with "actual time." But what about the second postulate of relativity?

In a chapter late in this book, the "Three Space Ship Paradox" will be discussed. This paradox is a proof that the speed of light cannot be the same for all observers. In this paradox three "space ships" are introduced, all of which are traveling at exactly the same velocity relative to a point that is "at rest" relative to CMBR. This means that the atomic clocks in all three of the ships measure

"time" exactly the same. However, the three ships are all traveling in different directions (direction is not an issue in this case because the space ships are not rotating with a planet). When a laser beam is fired from the "at rest" reference point, it is shown that all three ships will measure the speed of light differently.

This result should not be a surprise to anyone. Just as the first postulate of special relativity dealt with the paradoxical concept of "relative reference frames," the concept of "relative speeds of light" is equally paradoxical.

## I Am Not Alone

Prior to leaving this first overview chapter, I should mention that I am not alone in advocating the ether theory. Others who have devoted many years of their life to promoting the ether theory are: Maurice Allais (Nobel Prize 1988 - Economics), Harold Aspden, Steven Rado, Ken H. Sato, Gordon L. Ziegler, and many others. The list of anti-relativity scientists is even longer (generally scientists are anti-relativity because the verifiable formulas of relativity can be derived from classical physics and in fact many of the formulas used in relativity existed before relativity) (e.g. Stefan Marinov (deceased), Petr Beckmann (deceased), Howard C. Hayden, Tom Van Flandern, Franco Selleri, etc.). Many scientists are both pro-ether and anti-relativity.

Unfortunately, there has not been a lot of unity among the pro-ether forces. Theories are about as diverse as can be imagined. Some have diverted from using the term "ether" altogether. Hopefully, this book will provide the needed unity not only for the current pro-ether scientists, but for ***all*** scientists. My web site has links to a small sample of the pro-ether scientists: http://pages.sbcglobal.net/webster.kehr/

With all of this in mind it is important to identify the scientist that had by far the greatest understanding of ether, so that scientists will have a springboard from which to proceed. I don't think anyone would challenge the identity of that person - the super-genius Nikola Tesla. His numerous theories and inventions need to be reexamined in far greater detail.

## The Importance of a Knowledge of Ether

How will a knowledge of ether affect the future of physics? Ether has been around since the creation of the universe, and perhaps even before its creation. But the existence of ether is useless to the scientific community unless they believe that it exists. What is clear about ether is this:

1) Ether is the cause of every magnetic field.
2) Electricity could not exist without ether.
3) Ether is the medium for every electromagnetic wave, from radio waves to gamma rays.
4) Every particle in the universe is bathed in a sea of ether, including the orbiting electrons of atoms and plasma (I am sure there is a very interesting relationship between ether and plasma).
5) Ether is how particles moving near the speed of light in a vacuum "know" how fast they are moving, even if they are accelerated very, very slowly.
6) When ether gets cold enough, its properties change, causing strange phenomena to both atoms and light. In fact using very cold temperatures is a way to isolate exactly what ether affects. It may turn out that very cold temperatures are to "***ether physics***" as accelerators are to particle physics.
7) Ether also contains a massive amount of energy, as predicted by Tesla.

Many of the pro-ether people feel strongly that gravity and ether are tightly integrated. Also, some pro-ether people feel ether can be used to solve the "unified theory." Gordon L. Ziegler is one of those.

There is a famous quote from Nikola Tesla about ether (1891):

"Ere many generations pass, our machinery will be driven by a power obtainable at any point in the universe. This idea is not novel... We find it in the delightful myth of
Antheus, who derives power from the earth; we find it among the subtle speculations of one of your splendid mathematicians... Throughout space there is energy. Is this energy static or kinetic.? If static our hopes are in vain; if kinetic - and this we know it is, for certain - then it is a mere question of time when men will succeed in attaching their machinery to the very wheelwork of nature."

The time has come for scientists to resume the challenge that Tesla made in 1891.

The next four chapters will deal in far more detail with the Hafele-Keating experiment and SR. After the full discussion of the H-K, I will start discussing my own experiments and Lunar Laser Ranging experiments, which combine to add several paradoxes to the current list of paradoxes for the photon theory.

# Chapter 2

# The Stanford Linear Accelerator Experiment

"The reasonable man adapts himself to the world. The unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man."
George Bernard Shaw

## Introduction

Before talking about the experiment under study, let us first talk about what happens to a bullet when it is shot. If you shoot a bullet horizontally, the bullet will hit the ground fairly quickly (because of gravity) while it is still in motion. But now suppose we shoot a bullet into the ocean. This bullet will not go very far. How far it goes depends on the shape of the bullet, the weight of the bullet, and so on.

Suppose we were given the assignment to shoot a bullet from 100 feet from the ocean's water at New York City, and we were told to make sure the bullet traveled all the way to France underwater, and that the bullet must ***accelerate*** all the way to France, while it was underwater. Now that is an assignment**!**

Obviously, our only choice is to build some type of apparatus and put it underneath the ocean's surface. It must stretch all the way from New York City to France. Let us assume we build a very long metal frame, and attached to this frame are a series of electromagnets. These electromagnets must be coordinated by a computer. As the steel bullet travels underwater, each successive electromagnet provides a little bit more magnetic energy than the one before it. The electromagnets near France will be putting out a lot of magnetism.

But now let's change things. Suppose when the bullet is half-way to France all of the remaining electromagnets emit exactly the same magnetic energy. In this case the bullet will travel at a fixed rate of speed for the rest of the trip. But note that ***it takes energy to maintain a constant rate of speed*** for the bullet. Now let's suppose that when the bullet is three-quarters across the ocean that the framework loses electricity and all electromagnets turn off. Very quickly after this happens, the bullet will stop its forward motion and will fall to the bottom of the ocean.

So why is this framework necessary? The reason is resistance. The water is very dense, compared to the air, and a bullet encounters a lot of resistance when

it is traveling through water. Without an outside energy source, such as the framework of electromagnets, the bullet would quickly stop its forward motion.

## The SLAC Experiment

It takes only 4 inches, and common household electricity, to accelerate electrons to 30% of the speed of light in a vacuum (this happens inside of television sets all the time). Thus it should only take about 13 inches to accelerate electrons to the speed of light using household electricity. But it doesn't. In fact, it takes an enormous amount of distance and energy to accelerate electrons to near the speed of light.

For example, at the Stanford Linear Accelerator Center (SLAC) it takes 2 miles, massive amounts of energy, a long series of electromagnets (which are coordinated by a computer) and $300,000,000, to accelerate electrons to 99.999999992% of the speed of light in a vacuum[16]. The SLAC experiments were begun in the 1960s. A person might wonder why it takes so much distance and energy to accelerate the very small electrons.

The reason it takes so much energy is explained by the "Photon/Relativity Model" ("***PRM***") by using terms such as "relativistic mass increase." The increasing amount of energy needed (i.e. caused by increasing relativistic mass) is calculated based on the Lorentz transformation as applied by Einstein to relativistic mass.

In the PRM, the electron could be considered to be a coordinate system and the observer could be considered to be a coordinate system (actually the observer is fairly meaningless and can be ignored because the velocity of the electrons is compared to c, the symbol for the speed of light, not the observer). "Relativity," meaning the "relative" velocities of these two coordinate systems, however, could be used as an explanation (i.e. postulate) for why it takes so much energy to accelerate the electrons to near the speed of light in a vacuum. (Note: Technically, a point on the imaginary axis of the earth should be the "at rest' coordinate system for the SLAC, but as just mentioned, the observer is meaningless.)

Based on the experiments at the SLAC, it appears that Einstein's SR is true. But again, since this experiment was done in a vacuum, the "theory" does not explain the "cause" of the data, except to say that the "mass" or "inertia" of the object increases. That is interesting logic because "mass" is a measurement of how much energy it takes to accelerate something.

Consider this logic:
1) The amount of energy required to accelerate a particle increases because the "mass" of the particle increases at increasing speeds,
2) "Mass" is defined as the "amount of energy required to accelerate a particle."

Thus by substituting the definition of "mass" from the second statement into the first statement we get:
3) The amount of energy required to accelerate a particle increases because the [amount of energy required to accelerate a particle] ... increases at increasing speeds.

This is not an acceptable explanation for "why" it takes massive amounts of energy to accelerate electrons to near the speed of light. No one says that the electron itself incurs any physical change (except perhaps to contract in size). Some, however, say that an electromagnetic shell or field forms around the electron. However, even if an electromagnetic shell forms, there must be some reason "why" it forms and grows as a function of the speed of the electron. And there must be some reason why it adds "mass" to the electrons, since electromagnetic fields (around an electron) do not have weight.

A person might think that it is the rapid acceleration that causes the need for increased energy or that causes an electromagnetic shell to form around the electrons. But there is a profound problem with this theory.

Suppose we travel to a point in the universe that is halfway between two large galaxies. We will call this "***open space***." At this point in open space we are many tens of thousands of light-years from any celestial body other than individual atoms (as far as we currently know). Suppose we replicate the SLAC experiment except that we accelerate the electrons very, very slowly - at 1 kps per year. In this case it would take about 300,000 years to accelerate the electrons to near the speed of light. The formulas of the SR apply exactly the same. It would take the same amount of energy to accelerate the electrons from 99.9999% of the speed of light to 99.99999% of the speed of light whether in the SLAC or in open space between two galaxies. The difference is that in open space this amount of energy would have to be applied for a long period of time, compared to the SLAC.

It is actually more interesting to think about the slow acceleration of electrons than the fast acceleration of electrons. Once the electrons get to 99.99999% of the speed of light in open space, it takes an enormous amount of energy just to keep them moving at this same velocity, even if we ignore the slow acceleration. Why? Have the electrons become bigger or smaller, and even if that were true, why would their physical size make any difference - open space is a vacuum after all. In fact the vacuum in open space is much better than we can create on earth. The SR is mute on an explanation.

An interesting question posed on the internet is this: "How Does Light 'Know' How Fast to Travel?" (H.E. Retic - http://www.gti.net/retiche/texts.htm)
One could also ask: "How does an electron in a vacuum 'know' how fast it is going?" or "How does an electron in a vacuum 'know' to stop accelerating when it gets to the speed of light?"

All of this reminds us of the bullet in the ocean example above. It would seem logical that the electrons inside of the SLAC facilities are getting resistance from some substance, force or field. This resistance applies not only to the acceleration of the electrons, but also to maintaining a constant velocity for the electrons in open space.

While there are a number of substances, forces and fields that exist in the SLAC vacuum (e.g. nutrinos, gravity, electromagnetic fields, the magnetic field of the earth, etc.), let us talk about ether.

It is obvious that the vacuum created at the SLAC does not affect ether, meaning the SLAC cannot pump ether out of a tube. The density of ether inside the vacuum is identical to the density of ether outside the vacuum. Ether could provide resistance to the electrons in much the same way that the ocean water creates resistance to bullets. The ether theory not only creates a physical cause for the experiment, but a logical one also. What is not known is whether this resistance is more physical than electromagnetic or more electromagnetic than physical.

In either case, Rado sees strong similarities between Mach's formula for air resistance (actually, at high speeds Rado saw the need to embed the Mach-number into the formulas for Newton's law on compressible flow) and the Lorentz transformation applied to relativistic mass. As mentioned before, Lorentz believed in ether and ether was clearly on his mind when he developed the formula for the Lorentz transformation. Rado claims that the similarity between Mach's formula for air resistance and the formula for relativistic mass are cause for believing that relativistic mass is actually caused by resistance to ether.[17]

Thus, the ether model provides a physical and/or electromagnetic causal factor as to why so much energy is required, even if the electrons are accelerated very slowly. With ether, an electron "knows" exactly how fast it is traveling, just as a jet airplane would "know" how fast it is traveling through the air at a given altitude. The faster the electrons travel through the ether, the more physical resistance they encounter to the ether and the more energy is needed for them to maintain that velocity and even greater energy is needed to accelerate beyond that velocity.

This concept is so significant I have given it a name and an acronym. I call the resistance of ether to a particle: "Frontal Resistance and Obstruction of a

Substance ("***FROS***")." Ether is the substance that causes the FROS to an electron, in this case.

I should note that any time the letter 'c' is used in formulas, it actually refers to ether, since the "speed of light" is only a formula or symbol and a formula does not affect matter. The speed of light, and supposedly the maximum speed of any physical object, is a function of ether's properties, thus when any formula uses 'c' it is an indication that ether is directly involved in the phenomenon. The famous formula: $e=mc^2$ was derived from classical physics both before (i.e. when ether was believed to exist) and after the SR of 1905.
(Olinto De Pretto, per: http://www.italiansrus.com/articles/emc2.htm)

The SLAC is the beginning of a trend that will intensify as this paper progresses. The trend is that the PRM fails to supply a logical cause for the data, but the ether model not only provides the correct formulas, but also provides a logical and a physical cause. But things will get much deeper than that, as will soon be seen.

# Chapter 3

# The Hafele-Keating Experiment

"I particularly noted a regular practice of not re-examining the fundamental assumptions underlying a theory once it gained 'accepted' status, almost no matter how incompatible some new observation or experiment might be. And I saw powerful vested interests in a 'status quo' develop around certain accepted theories."
Tom Van Flandern

## Description of the Experiment

The next experiment to be discussed is the Hafele-Keating ("***H-K***") experiment of 1971, which was introduced in the first chapter. In this experiment, the ***location*** of the "at rest" observer (i.e. "at rest" reference frame or coordinate system) is much more significant than it was in the SLAC. This is because the velocities of the objects in the H-K are no where near the speed of light, thus unlike the SLAC, the location of the "at rest" reference frame is very important. In fact, the velocity of the objects in the H-K is ***slower*** than the rotation velocity of the earth.

Hafele and Keating flew four cesium atomic clocks around the world in commercial jet airplanes; first all 4 clocks were flown eastbound around the world, then they were flown westbound around the world.

After the experiments, Hafele and Keating published two articles in the same issue of Science. In the first article, there are detailed predictions of the time changes in the atomic clocks due to both kinematic (SR) and gravitational (GR) affects. It was impossible to make these predictions until after the experiments were completed because they had no way of knowing in advance how fast the jet airplanes would be flying or at what altitudes they would be flying, etc.

In the second article they have the actual data of the experiments. In this article it was impossible to segregate the actual time differences in the clocks between gravitational and kinematic (i.e. velocity and direction) affects because it was impossible to have separate clocks measuring separate effects. Thus their ***predictions*** include a separation between the gravitational effects and the kinematic effects, but their ***actual*** data cannot make this separation. Here is the predicted data, based on the actual jet airplane flight data:

| **Predicted Data** | **Direction of Airplanes** | |
|---|---|---|
| **Effect** | **Eastbound** | **Westbound** |

| | | |
|---|---|---|
| Gravitational | 144 +/- 14 | 179 +/- 18 |
| **Kinematic** | **-184 +/- 18** | **96 +/- 10** |
| Net | -40 +/- 23 | 275 +/- 21 |

The actual data is as follows: the eastbound clocks ***lost*** 59 +/- 10 nanoseconds and the westbound clocks ***gained*** 273 +/- 7 nanoseconds. The authors felt the experiment was very successful - and it was.

Note especially that the atomic clocks in the westbound plane actually operated at a faster rate than the stationary clock due to kinematic effects, but that the eastbound plane operated at a slower rate than the stationary clock due to kinematic effects. Direction had no affect on the gravitational part of their predictions except that the jets flying westbound must have flown at a different average altitude (no doubt higher) than the jets that flew eastbound. Or other factors could have come into play, such as latitude.

Now let's elaborate on why the rotation of the earth was the real issue behind the importance of the direction the airplanes flew.

A drawing in an article by Hafele, which was undoubtedly sent to the publisher before his experiments were performed in October of 1971, clearly demonstrates what he meant by his "nonrotating observer looking down on the North Pole from a great distance."[9] This same drawing explains why direction was so important. I will describe the same concepts using the center of the earth as the "at rest" reference point. Actually, any point on the elongated, imaginary axis of the earth could have been used as the "at rest" reference point.

If a nonrotating person were sitting at the center of the earth looking up at the stars (let us assume the earth is hollow), the person would think he is stationary and that a stationary atomic clock sitting on the surface of the earth was in motion. From the North Pole the earth rotates counterclockwise. From the center of the earth the person would be at the center of a rotating disk (the equator would represent the edge of the disk), and the stationary atomic clock would appear to move in a direction defined to be "east."

For example, using "round numbers" (i.e. approximations in order to focus on concepts), suppose the earth rotated at exactly 1,000 mph on the equator. If a nonrotating person were sitting at the center of the earth looking up at the stars, a stationary atomic clock on the equator would appear to be traveling at 1,000 mph eastbound due to the rotation of the earth. It would look much like a satellite.

Thus, if the westbound jet traveled at 350 mph, on the equator, then the person at the center of the earth would see the westbound clock moving at 650 mph ***eastbound***. That is, the earth would rotate the westbound jet at 1,000 mph eastbound, but the westbound clock and jet would fly westbound at 350 mph,

thus giving a net velocity of 650 mph ***eastbound*** (1,000 mph east minus 350 mph west).

Because the clocks in the westbound plane appear to move slower than the stationary clock (650 mph eastbound versus 1,000 mph eastbound), relative to this observer, according to the SR, the clocks in the westbound plane would operate at a faster rate (i.e. faster actual time) than the stationary clock. That is what Hafele and Keating observed.

Likewise, to a person at the center of the earth, the eastbound plane (i.e. the clocks in the eastbound plane) would appear to be moving at 1,350 mph (1,000 mph rotation of the earth velocity plus 350 mph ground velocity, both eastbound). Thus, the eastbound clocks would operate more slowly than the stationary clock because of their faster relative velocity. This is also what was observed.

The SR formulas were applied to 650 mph (westbound plane, the fastest clock), 1,000 mph (stationary clock) and 1,350 mph (eastbound plane, the slowest clock). These are my very simplified numbers, not the actual data as shown above.

What their experiments prove is that a jet airplane's velocity and direction have a predictable affect on "actual time" changes recorded by atomic clocks inside of the airplanes. Planes that fly eastbound decrease their "actual time" and planes that fly westbound increase their "actual time," both relative to a "stationary" atomic clock. But remember that the "stationary" clock is also in motion relative to the center of the earth. For now I am ignoring the factors that involve general relativity, namely altitude.

Hafele and Keating applied the special relativity formulas to two types of coordinate systems. The first type was the nonrotating "at rest" coordinate system which consisted of a point on the extended axis of the earth ("a nonrotating point high above the North Pole"). According to Einstein, the axis of a rotating disc should be the one and only "at rest" reference frame of a rotating disc.[12] This was not in his original 1905 paper, but it came later. Thus, Hafele and Keating used a point on the axis of the rotating earth as their "at rest" reference frame.

The second type of coordinate system was the atomic clocks, which were part of the experiments. Each atomic clock, even the stationary clock, was considered to be a coordinate system that was in motion relative to the "at rest" reference frame, or reference point to be more accurate. In the original SR there was only one type of coordinate system, the objects in the experiment, and the "at rest" reference frame was any of those objects.

## Introduction to Ether and the H-K

If we consider Michelson's model of ether drag, since all of the ether inside the ether drag is at rest, and does not rotate with the earth, the axis of the rotating earth is at rest because it is not in motion relative to the ether drag. In other words, the axis of the earth is not spinning with the earth (it is the center of a rotating disc), thus it is not in motion relative to ether drag. Thus, the velocity of all objects relative to the stationary ether in the ether drag has the same velocity (of these objects) relative to the axis of the rotating earth. Thus, the special relativity "at rest" reference frame is effectively the same as the ether drag "at rest" reference frame (i.e. the ether drag itself). In fact, Hafele and Keating could have used either the PRM (Photon/Relativity Model) "at rest" reference frame or the "bubble" of ether drag and the velocity of the objects in their ambient ether.

If ether causes resistance to the SLAC electrons, it also caused resistance to atoms inside of the atomic clocks. Exactly how the ether might affect the frequency of the atomic clocks is not known, but most likely it has to do with resistance to the cesium atom electrons (which would be more affected by the ether than the very heavy nucleus). The velocity of an atomic clock, relative to the stationary ether, will have a direct affect on how much resistance is experienced by the cesium atoms. Thus, if the jet goes "relatively" faster in the ether drag (i.e. faster in the ambient ether) the atoms will be affected by additional resistance and the frequency change will cause "actual time" to slow down. It the airplane goes "relatively" slower in the ether drag the clocks will speed up because of lessened resistance.

The H-K experiment is very similar to the SLAC experiment, in the sense that ether is causing resistance to electrons, but there are two differences. The first difference is that in the H-K each electron is part of an atom. The second difference is more complex and needs some explanation.

In the SLAC, the velocity of the electrons could be controlled by human beings by simply increasing or decreasing the amount of energy that was applied to the electromagnets. When an electron is attached to an atom, that is not possible to do in the same kind of way.

When an electron is attached to an atom, it is generally assumed by scientists that the electrons in atoms move at the same velocity at all times. Suppose an electron has resistance applied to it. In order for this electron to maintain the same velocity in the atom, there must be something in the atom that ***detects*** the change in resistance and there must be some mechanism in the atom that can physically ***change*** the energy to the electron so that the electron can maintain a constant velocity. The energy must be added, if resistance is increased, or must be reduced, if resistance is reduced.

For example, let us suppose one person spins a globe. Suppose another person pushes their hand against the globe causing resistance to the globe's surface. In order for this globe to continue spinning at a constant velocity the resistance must first be detected and then another force must offset the resistance to the globe's surface. The same thing must happen in an atom if an electron is to spin at a fixed velocity. But there is nothing in an atom to detect a change in resistance and there is nothing, that we know of, that can adjust the energy to the electron so that it will spin at the same velocity.

The only logical conclusion to draw is that when the resistance to electrons increases or decreases, the electrons physically slow down or speed up, respectively, and the "time" measured by the atomic clock slows down or speeds up, respectively.

Even if an airplane were flying such that the ambient ether wind was zero (i.e. it was flying westbound at the exact rotation speed of the earth), ether would still be surrounding each atom and would still be providing resistance to the electrons. In other words, ether is ***always*** applying resistance to electrons, even if the atoms are "at rest" relative to their ambient ether.

However, if one airplane is flying slower than another airplane, relative their ambient ether, the slower plane (i.e. the atoms in the slower plane) will experience less resistance due to the ether than the faster plane. This means that its electrons will be moving faster and its time will measure time faster. Note that the electrons in human bodies experience resistance to ether, thus "actual time" as measured by human beings would also speed up and slow down, though such a change could not be measured at the velocities of jet airplanes.

In summary, if there are three planes, and they are all moving at different velocities, relative to their ambient ether, they will measure time differently. The slowest plane, relative to ambient ether, will measure the fastest time and the fastest plane, relative to ambient ether, will measure the slowest time.

(Note: In this book I talk about electrons physically "speeding up" and "slowing down." This is based on the model of atoms currently in use. Should the model of atoms change, such as the discovery of "ether drag" at the atomic level, or the discovery of some new type of substance that surrounds each atom and stores the energy in atoms, the concept of "speeding up" and "slowing down" could very easily become outdated.)

(Note: I should also mention that it has been shown that all atomic clocks on the surface of the earth experience the same "actual time," even for atomic clocks at different latitudes. In simplistic terms, the gravitational differences on the surface of the earth offset the kinematic differences on the surface of the earth due to latitude.[18])

As mentioned in Chapter 1, the concept of "relative reference frames," that every reference frame can be considered to be "at rest," is false (i.e. it is false to claim that every reference frame can be considered "at rest" relative to any other reference frame). Every reference frame must be compared to its ambient ether, which is essentially a local URF or local ARF. Ether, of course, is not uniformly stationary throughout the universe, thus the concept of "ambient ether" has yet to be well understood.

In the "old SR" any two moving reference frames could be ***directly*** compared to each other. In the ether theory, two reference frames can only be compared to each other ***indirectly***, meaning each reference frame must first be compared to its ambient ether and then it can be calculated how the two reference frames relate to each other indirectly. It is a two step process. First, determine how each reference frame compares to its ambient ether, then step two is to compare the two reference frames indirectly to each other. Thus the ether theory has no problems with the "clock paradox" or the "twin paradox."

(Note: What if the ether surrounding an atom were removed (physically or effectively) and the atom was sitting in an ether vacuum? Would its electrons spin so fast that they would literally fly off of the atom or would the electrons collapse into the nucleus? This, and many other questions, are very interesting to think about with respect to ether.)

(Note: It is also possible that it is the ether that is ***causing*** the electrons to spin in the first place, either directly or indirectly, by applying energy to the atom. I have often wondered how electrons get their energy. In other words, why is it that electrons can continuously spin around a nucleus for billions of years? Where does their energy come from, meaning how does an electron spin at roughly the same speed for billions of years? The answer is certainly not inertia. It is not likely that a nucleus contains enough energy to support its electrons for that length of time. Something ***from outside*** of the atom probably supplies the energy to either the nucleus or to the electron during the lifetime of an atom. It is very logical to think that this outside energy source is ether. This would imply, and ponder this carefully, that the ether might be an ***energy source*****!** Alternatively, it is possible some source of energy elsewhere in the universe is transmitting energy through the medium of ether. It has been stated by multiple people that in a vacuum, even the size of a coffee cup, there is an enormous amount of energy. It is clear that Tesla tapped into that energy source, though to what degree this is true is not clear.)

## What is the Direction of the Ether Wind?

In this first example imagine you are sitting on a flatbed train car. Suppose there is no wind and you are sitting perfectly still. Suppose the train, and you, are facing east and that the train is moving at 60 kph. You will feel a 60 kph wind in

your face. Now let us suppose the train, and you, are facing east, but the train is not moving. In what direction would the wind have to move in order for you to have exactly the same wind in your face? The answer, of course, is westbound. If both you and the train are facing eastbound and are stationary, and if a 60 kph wind is moving to the west, you will have the same feeling on your face as if there were no wind and the train were moving eastbound at 60 kph.

In this second example remember that with ether drag, the earth rotates underneath the ether in the ether drag. Let us compare this second example to the first example. The motionless wind in the first example is equivalent to the motionless ether in the second example. Suppose you are facing east in both examples. Now let us compare the moving train in the first example to the rotating (surface of the) earth in the second example. In other words, just as the moving train pushes you trough the motionless air, the rotating earth is pushing us through the motionless ether because the earth rotates underneath the motionless ether. If you could feel the ether wind (which you can't), and you were on the equator, you would feel it hit your face at a 1,600 kph clip. Therefore, in what direction does the ether wind effectively move? Just as in the first example, it effectively moves westbound.

Even though the ether is motionless, or almost motionless, the rotation of the earth through this ether has the same effect as if the earth were stationary and the ether was moving at 1,600 kph westbound on the equator.

Now let us consider the jet airplanes in the H-K. The westbound flights would have been flying in the same direction as the ether wind, causing less resistance (than a stationary clock) and would measure faster time (than a stationary clock). Likewise, when the flights were headed eastbound, they would have been flying into the ether wind, thus causing more resistance and slowing time down.

Since we are assuming that the earth rotates at exactly 1,000 mph at the equator, an atomic clock on the equator would have the equivalent of a 1,000 mph ether wind applied to it. The westbound clock would be flying with the ether wind, thus its speed relative to ambient ether would be 650 mph (1,000 mph minus 350 mph since both the wind and plane are moving in the same direction). The eastbound clock would be flying into the ether wind, thus its speed relative to ambient ether would be 1,350 (1,000 mph plus 350 mph because they are moving in opposite directions). These are the same simplified numbers we calculated above.

Thus the ether theory makes exactly the same predictions as the SR as to whether the clocks speed up or slow down relative to a stationary clock, and by how much. This should not come as a surprise because both the H-K "at rest" reference frame and the ether drag reference frame generate exactly the same coordinate system.

Assuming the ether drag theory, the H-K proves the existence of the ether wind and it proves that the earth rotates underneath the ether drag as stated by Michelson**!**

# Chapter 4

# The Anemometer Metaphor

"That which is looked upon by one generation as the apex of human knowledge is often considered an absurdity by the next, and that which is regarded as a superstition in one century, may form the basis of science for the following one."
Paracelsus (1493-1541)

## Introduction

As mentioned in Chapter 1, the version of the SR that Hafele and Keating used in their famous 1971 experiment is vastly different than the 1905 version. At the end of this chapter the differences between the original SR and the current or new SR will be better understood. But in order to accomplish that, it is critical that a metaphor be used to set the stage and establish important visualization concepts and terminology. This metaphor will be the bridge between the SR of 1905 and the "new SR" currently being used in physics. It will also aid immensely in an understanding of the H-K discussions in the next chapter.

The real purpose of this chapter, however, is that I want to make it ***perfectly clear*** that there must be a ***cause*** of the Hafele-Keating data. The fact that the SR changed from an "imaginary time" to an "actual time," but failed to make the transition from an "imaginary cause" to an "actual cause" must be clearly understood**!** This chapter will make it clear.

## The Anemometer Metaphor

An "anemometer" is an object commonly used by meteorologists or weathermen to measure the speed or velocity of the wind. It consists of several cups (i.e. hollow hemispheres or hollow cones), placed on rods that are attached perpendicular to a vertical pole. The anemometer spins around as a function of the velocity of the wind (i.e. if the wind moves faster, the anemometer spins faster).

Now consider an automobile that has a long pole vertically attached to its roof and on top of this pole is an anemometer. Assuming there is no wind, suppose the automobile is driven across a large parking lot at 80 kph (kilometers per hour). Two teams of physics students, Team A and Team B, observe that as the car increases in velocity to its cruising speed, the anemometer spins ever faster

and faster. Once the car reaches its cruising speed, they observe that the anemometer spins at a constant rate.

Note that whether the car is standing still and there is an 80 kph wind, or whether there is no wind and the car is moving at 80 kph, the anemometer will spin at exactly the same rate. Normally, anemometers are attached to building and thus they measure the velocity of the wind. But in this case it is assumed that there is no wind, but the anemometer is moving (i.e. the car it is attached to is moving).

Let us assume that two sets of physics students, Team A and Team B, are given the task of figuring out "why" (i.e. the "cause") the anemometer turns and to derive formulas to predict its spin velocity at different speeds of the car.

Let us assume the students in Team A have not yet been taught about small particles (i.e. air and wind) and they calculate the increasing spin on the basis of the "***relative***" velocity of two "***coordinate systems***." A "coordinate system" can be thought of as any object that has measurable motion, even if that motion is 0 kph. For example, the car (or the anemometer) will represent one coordinate system and an observer standing on the pavement will represent the second coordinate system. In this case the car accelerates to 80 kph, but the observer is standing still on the pavement and is thus traveling at 0 kph. When the car has reached its cruising speed of 80 kph, the "relative" velocity of the two coordinate systems is 80 kph because the car is traveling at 80 kph and the observer is traveling at 0 kph. To obtain the "relative" velocities it is simply necessary to subtract the velocities of the two coordinate systems in this simple example - 80 kph minus 0 kph equals 80 kph. Note that the "relative" velocity is actually the speed of the car, since one of the coordinate systems is not in motion and is always 0 kph.

Team B, on the other hand, believes that small particles called "air" are causing "***resistance***" to the cups. They had observed that if they stuck their hand out the window of a car when it is traveling 80 kph there is some invisible force that pushes against their hand much more strongly than if the car was traveling at 10 kph. They concluded that the same force that pushes against their hand was the same force pushing against the anemometer cups.

Team B derives their formulas based on resistance to predict the spin velocity of the anemometer, meaning based on the velocity of the anemometer to its ambient air stream. Thus Team A based their formulas on the relative velocity of the anemometer and the observer, but Team B based their formulas on the velocity of the anemometer and the ambient air or wind that surrounds it (i.e. the ambient velocity).

Both Team A and Team B derive exactly the same formulas. This is because in the case of Team A, the observer is stationary, thus the velocity of the car is also the relative velocity of the car and observer. Furthermore, there is no wind.

Also, in the case of Team B, since there is no wind, the velocity of the car is also the relative velocity of the car and the air. Thus both teams generate exactly the same formulas.

## The First Experiment

Because Team A and Team B have the same formulas, but not the same theories as to "why" the anemometer spins, two experiments are set up. In the first experiment the observer of Team A runs behind the car at a speed of 15 kph, and the car and wind act exactly as before, namely the car accelerates from 0 to 80 kph and there is no wind. In this experiment, it is noted that when the car reaches 80 kph, the "relative" velocity of the car and the observer is 65 kph (because the observer is running at 15 kph behind the car). However, it is noted that the anemometer spins at exactly the same velocity as it did in the original experiment. Thus Team A derives the wrong formula, but Team B continues to derive the correct formula.

Team A thinks they have the answer to the fact their formulas don't work. They claim that their formulas are based on the "apparent" or "relative" perspective of the observer. They claim that because the observer is running, he "thought" that the anemometer is rotating at a velocity based on a 65 kph speed of the car. In other words, they claim that the observer, since he would be in motion, observes the spin velocity of the anemometer differently than he would if he were "***at rest***," meaning standing still on the pavement and moving at 0 kph. Under this assumption, the formulas of Team A work.

The leader of Team B asks the question: "suppose there are two observers, one standing still on the pavement and one running behind the car at 15 kph, then how fast is the anemometer rotating?" Team A answers that the "at rest" observer will "see" the anemometer rotating at an 80 kph spin velocity and that the running observer will simultaneously "see" the anemometer rotating at a 65 kph spin velocity. Team A thinks they have proven that "air" doesn't exist.

## The Second Experiment

Now a second experiment is designed. In this experiment everyone waits until the wind is blowing at exactly 15 kph ***in the same direction*** the car will be headed. At this point the car is accelerated exactly as it originally did and the observer is stationary. In this case, the "ambient velocity" of the wind and the anemometer becomes 65 kph, however, the "relative velocity" of the observer (who is standing still in this experiment) and car is 80 kph. In this case the anemometer is actually spinning more slowly than it did in the original experiment.

Because the observer is not running in this case, the formulas of Team A do not "work" (i.e. they do not correctly predict the spin velocity of the anemometer), because they predict the spin velocity based on 80 kph. But the formulas of Team B do work when the wind is moving at 15 kph in the same direction as the car. Remember Team B is comparing the anemometer to the ambient velocity of the wind that surrounds it. Team A has no answer for their failure in this case because they do not believe in "air," and to adjust their formulas for "wind" would be to admit that they believe in air.

## Formulas Versus Theories

One of the most common errors made in physics is not thinking ***independently*** about a formula (or raw data) and a theory. Note that the "formulas" of Team A are valid (if there is no wind and the observer is stationary) and can be verified by anyone. The data that leads to the formulas (ditto) is also verifiable and replicable. However, the "theories" of Team A are false, even though their formulas are correct, and therefore their formulas at times do not work and at other times Team A has to give some strange and paradoxical explanations to justify their results. Their "theories" are that it is the relative motion of the observer and anemometer that cause the anemometer to rotate, but in fact it is the relationship between the ambient air and the anemometer that causes the anemometer to rotate. In fact a person could argue that Team A doesn't even have a "theory" since they make no explanation for a cause of why it is the relative difference between the observer and the anemometer that causes the anemometer to rotate. More will be said about this in a future chapter.

## What it takes for Team A to Look Good

Now let us take this example a little further. How can Team A get their formulas to work in every case and thus have a chance of always being right? Ponder that question before reading on.

The answer is for Team A to require that the observer is always standing still and that there be no wind during the contest. Thus they only allow one observer coordinate system, one that is not moving, and is always "at rest," meaning standing still, and they require that there be no wind. In this case their formulas will always work.

There is another way to look at this. Team A must make sure the observer is moving in the correct direction and velocity relative to the anemometer when they build their mathematical model. In other words, they must pick the correct "at rest" motion of the observer. In this case the correct direction and velocity is 0 kph (of course, assuming no wind). But suppose they had incorrectly concluded that the correct direction and velocity for the observer was to run behind the car

at 15 kph because on the day they made this calculation there happened to be a 15 kph wind moving in the same direction as the car. They would have picked the wrong "at rest" motion of the observer and their formulas would not have worked on days when the wind was not moving or was moving at a different speed or in a different direction. In summary, with the right restrictions (no wind), and the correct choice of the "at rest" reference frame, Team A will always get the right answer from their formulas even though their theory is totally wrong.

There are several things to learn from the Anemometer Metaphor:

1) The "formulas" of Team A can be perfectly valid, but their theories can be totally false (this is "***bifurcating***" a formula [or data] and a theory).
2) Team A's formulas are dependent on choosing the correct direction and velocity of the observer (and that there is no wind).
3) Team A offers no physical cause as to why the cups rotate, they only offer a formula that works if the correct direction and velocity of the observer is used and there is no wind.
4) Note that if the direction and velocity of the observer changes (i.e. he starts running when he is supposed to be standing still), it will have no affect on the spin velocity of the anemometer.
5) Since the formulas of Team A involve the "relative" velocity of the anemometer and the observer, the observer is part of the formula (i.e. a factor must be in the formula for the direction and velocity of the observer in order to calculate the "relative" velocity of the two coordinate systems). Because the observer is part of the formula, it is only natural and logical that the observer would have some ***affect*** on the spin velocity of the anemometer. In other words, because the observer's direction and velocity are built into the formulas of Team A, then the observer's direction and velocity should affect the actual spin velocity of the anemometer. Or to put it yet another way, since the direction and velocity of the observer is part of the formula, if the observer changes direction and velocity, the rotation velocity of the anemometer should change. But it doesn't. So why is the observer's direction and velocity part of the formula?

Based on the first chapter, the reader should already see why the Anemometer Metaphor is so similar to the SR. However, there is much yet to be said about the SR.

# Chapter 5

# What Does the Hafele-Keating Tell Us?

"I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use."
Galileo Galilei (1564-1642)

## Separating Data From the Cause

Let me remind the reader that my definition of a **"theory"** includes the concept of a ***cause*** of why something happens (see Chapter 1). Furthermore, a hypothesis or assumption, by my definition, does not contain a statement of cause.

In any experiment, the experiment can be divided into two very distinct areas. In fact these areas are so distinct that they should be kept separate (i.e. bifurcated). First, is the "***data***" or "***formulas***" of the experiment. These items are hopefully very "***objective***." The data can be duplicated by others and the formulas tested. Second, is an explanation of ***why*** the data occurs, meaning an explanation for the ***cause*** of the data. This is the "theory." Theories can be very ***subjective*** because different scientists may have different opinions about the cause of the same phenomenon or data.

There have been many situations in the history of science where every scientist believed the same theory, and all of them turned out to be wrong. The classic example is Ptolemy's epicycles: "If it is made complex enough, the Ptolemaic system can predict planetary positions correctly. But the Sun-centered system is much simpler, and ultimately we prefer it for that reason." Tom Bethell (The Americal Spectator Online, April, 1999)

Many "theories" in physics, even today, are vulnerable to further refinement or total rejection. In quantum mechanics, general relativity, special relativity and the photon theory, actual data has driven theories to be increasingly irrational and paradoxical.

But if the data is correct, no one can debate the actual data (particularly if it is verified independently by others). The formulas can come before or after the actual data, but almost always the formulas come after the data, unless similar formulas already exist for some comparable phenomenon. In rare cases a scientist may keep it a secret that their formulas were actually based on empirical data, but they may claim that their formulas were based solely on theory and that

they correctly predicted the data, when in fact they already knew what the data was going to be.

Let me give a case study of why it is important to separate the "data" from the "theory." Later in this book there will be a chapter on the De Witte Effect. De Witte is an engineer in Belgium. During a 178-day long experiment, he detected a consistent phase shift in electrical frequencies. What was amazing about these phase shifts was that they followed a consistent sinusoidal curve with a "sidereal day" period. I will explain what all of this means in the later chapter, but for now I want to emphasize that this was his "data."

De Witte's web site[19], and his claims as to what his data implied, are quite dramatic. He claimed to detect the ether, which is something the scientific community does not take lightly. To use my terminology, his "theory" was that he had detected ether. He also could be found on the Internet news groups debating other scientists.

Those few scientists who were aware of De Witte's experiment rejected his theory. But in doing that, ***they also rejected his data!*** It is totally inexcusable that any scientist would ***reject data*** just because they ***reject a person's theory***. It is not science**!** Data is data and data needs to be totally separated from a person's personality, the way he or she dresses, the way they comb their hair, how many kids they have, their personal lifestyle, their education, and their theories. Even if De Witte had claimed to prove the moon was made out of cheese, the scientific community should have taken his data very seriously. They didn't.

While it is true that some scientists have created bogus data, generally data that leads to new concepts can be verified or be proven to be false. No one has ever proven or even suggested that De Witte's data was bogus or false. In fact, my experience in the fiber optics field tells me his data is quite plausible and believable. But for the scientific community to reject his data because they reject his theory is simply inexcusable.

Unfortunately, journals reject many articles, ***and the data that accompanies those articles***, because they do not like the author's theory, or because the theory is not popular, or because the author doesn't have the right credentials, ***ad nauseum***. Because of this there is a tremendous amount of critical data that is lost to the scientific world.

The case of Special Relativity is exactly the opposite of the De Witte experience. In the case of the SR and GR, because the formulas of the SR and GR seem to work, the scientific community blindly ***accepted the "theories" of the SR and GR***. The fact that Einstein's formulas worked should not have been a surprise since many of them existed before he published them. But because his formulas worked, his theories were accepted, even though the SR contains no causal

agent and the GR is totally obfuscated.[20] ***In the case of De Witte, the data was rejected because the theory was rejected. In the case of Einstein, because the formulas were accepted, the theory was accepted.*** It is exactly the same error. Data and theories need to be kept totally separate.

I once received a letter from a journal that included this statement: "The theory of relativity, ..., is one of the most thoroughly tested ***theories*** in modern physics." [italics added] This common statement is a direct result of using a definition of "theory" that is so general that it allows assumptions, that contain no causal explanations, to be considered a "theory." It is a matter of semantics, but it is an example of how the scientific community ignores the issue of cause. The "theory" of relativity has never been tested, nor can it be tested, because there is no "theory" in the SR. But yet it has been accepted as a full fledged "theory" that explains the cause of the H-K data**!** The "formulas" of the SR have been thoroughly tested in many situations, but there are competing models that do contain actual theories, that lead to basically the same formulas. In other words, unlike the SR, these competing models include a logical causal agent as to why the data results.

The scientific community should learn from their lessons. They should learn that everything must have a cause. Maybe we don't know what the cause is, or maybe no one can comprehend a model that fits the data, but everything, everywhere, must have a cause. While the subject of "action at a distance" may be up for debate, the issue of "everything must have a cause" is not up for debate.

The Hafele-Keating experiment contains "data." The SR and GR are used to explain why the data resulted. But the "theory" of special relativity is identical to the "theory" of Team A in the Anemometer Metaphor. The SR provides formulas, but offers no logical causal agent as to why the formulas work.

As mentioned in the anemometer metaphor, if the observer is running behind the car it will not change the velocity of the cups rotating on the anemometer. We could ask the same question here. Suppose we flew a helicopter high above the north pole. Suppose we put an atomic clock inside of this helicopter and declared that this helicopter was our "at rest" reference frame for a new "Hafele-Keating" experiment. Suppose that during the experiment the helicopter started flying towards Oslo at 500 kph. Would the motion of our "at rest" reference frame change the "actual time" measured by our new atomic clocks? Of course not.

Yet this would have been allowed in the 1905 SR. Clearly the choice of the "at rest" reference frame was simply to get the formulas to work, and it had absolutely nothing to do with the "actual time" measured by the atomic clocks in the H-K. On the other hand, if there was some way to get the ambient ether drag in motion (ambient to the clocks), it ***would*** have an affect on the "actual time" measured by the clocks.

## Is "Relativity" Logically Consistent With the Hafele-Keating Data?

The vast distance, many thousands of kilometers, between the "at rest" coordinate point and the atomic clocks in the H-K provides us with a new tool to view the ether-photon debate. In both 1905 and 1924, the "steady state" theory was generally believed. This theory was that our sun is perfectly "at rest" in the Universe. This "at rest" reference frame would have been believed to be totally "at rest" with respect to the ***entire universe*** in 1924. Einstein basically stated that if there was a URF, he would use it. At that time in history, the center of the sun ***was*** considered a URF**!** In 1920, why didn't Einstein state that the center of the sun was his choice for an "at rest" reference frame?[21] Such a choice would have been the perfect choice in 1920, but obviously he had access to some empirical data. But with the modern knowledge of astronomy, we know of things even more at rest than is our sun. But in spite of this, "a point high above the North Pole" is still the one that works.

Since the imaginary axis of the earth is the only "at rest" reference frame that gets the formulas to work, then the axis of the earth must be a very significant part of the ***cause*** of the data (remember, "relativity" is a postulate). In other words, there must be something about the imaginary axis of the earth that causes the frequency of cesium atomic clocks, thousand of kilometers away, to change their frequency as a function of the direction and velocity of the jets that carry them, to the exclusion of all other "at rest" reference frames.

In physics the "cause" of the data and the "formulas" that predict the data should be kept separate in our minds, but on the other hand they also should be logically related. Because the "at rest" reference frame is part of the ***formulas*** of "relativity," it must therefore be part of the ***cause*** (postulate or no postulate) of actual time changes in atomic clocks thousands of kilometers away. But all of this sounds illogical. An imaginary axis that is thousands of kilometers from the experiment logically cannot be a cause of actual frequency changes in atomic clocks and cannot prevent other "at rest" reference frames from also causing time changes to the clocks.

To put this another way: is the choice of the "correct" at rest reference frame a contributing ***cause*** of the data or does it's choice simply ***tell us something*** about the properties of the substance, force or field (i.e. causal agent) that does cause the resistance to the cesium atoms? In the case of the H-K, the answer is logically "neither." An imaginary axis thousands of kilometers away is neither the cause of the data, nor does it tell us anything about the substance, force or field that does cause the data because there is no substance, force or field emanating exclusively from the imaginary axis of the earth that has the correct coordinate system.

The axis of the magnetic field of the earth is close to being the rotation axis of the earth, but the magnetic field of the earth rotates with the earth, thus the stationary clock would not be in motion relative to the magnetic field of the earth. In other words, the stationary clock would be "at rest" relative to the flying clocks and could have been used as the "at rest" reference frame. Because the formulas don't work if the stationary clock is considered "at rest," we can reject the magnetic field of the earth as a cause of resistance. Ditto for the earth's gravity (GR). Furthermore, if we used the earth's magnetic field or the GR, the data from the flying atomic clocks would have been backwards.

However, remember that there are two "at rest" reference frames the H-K could have used, not just one. The imaginary axis is clearly illogical, but the other choice is perfectly logical. Suppose the H-K had used a "bubble" around the earth as their "at rest" reference frame. Suppose this bubble is filled with a substance, force or field that is stationary (i.e."at rest") inside the bubble (i.e. it doesn't rotate with the earth) and it extends high above the altitudes of the jet airplanes. This choice of an "at rest" reference frame would work with the formulas, would have the correct coordinate system, and would even shield the cesium atoms from the reference frame of the sun (i.e. the sun's ether drag), for example.

But in addition, this choice is logical because the substance, force or field that creates this bubble comes into ***direct contact*** with the atoms in all of the atomic clocks - it is not thousands of kilometers away. Thus, there is a logical relationship between the formulas and the substance that causes resistance to the atoms in the clocks**!** This is a far more logical choice for an "at rest" reference frame than an imaginary axis thousands of kilometers from the experiment, coupled with a postulate that offers no explanation for a physical cause.

We now have enough information to ask some key questions. We now know that the substance, force or field that caused actual time changes in the H-K atomic clocks must have at least the following properties:
1) It must be able to cause resistance to electrons. I say "resistance" because as the clocks move faster through the substance, force or field, the time measured slows down.
2) It must "shield" the earth from the affects of this substance, force or field from the motion of the earth's orbit around the sun and our total motion in space or else the substance (i.e. extraterrestrial substance) would cause data that was not consistent with the formulas of relativity. This means the substance, force or field must create a "bubble" around the earth at least to the altitude of the H-K jets to shield the atomic clocks (this eliminates nutrinos and the sun's gravitational field, for example).
3) This substance, force or field must be virtually motionless inside of its own bubble, such that it does not rotate with the earth (this eliminates the magnetic field of the earth and the gravitational field).

4) Objects on the surface of the earth (such as the stationary atomic clock) cannot be motionless with respect to this substance, force or field. They must be exposed to resistance at the same velocity as the rotational velocity of the earth at their latitude (this also eliminates the earth's gravitational field and magnetic field).

The list could go on, but it should be clear from Chapter 1 and this chapter that the only substance, force or field that meets all of these criteria is ether and ether drag.

## What if Contact Enhanced the Cesium Atoms?

Suppose someone were to say that the faster an object flies through a substance, the ***faster*** its "time" will be measured. This theory might be put forth to claim that the magnetic field of the earth "enhanced" the cesium atoms the faster they flew through the earth's magnetic field (or ditto for the gravitational field). There are two problems with this theory.

First, the Hafele-Keating is a "slow" version of the SLAC. It is clear, that because electrons require more energy to speed up as they get near the speed of light, that some substance, force or field is causing ***resistance*** to the SLAC electrons. It would be hard to image that less energy would be needed to accelerate the electrons as they got closer to the speed of light. Since both the SLAC and H-K deal with some substance, force of field coming into direct contact with electrons, it is clear that it is the ***same*** substance that affects both experiments. This means that resistance is the cause of the data of both experiments.

Second, as has already mentioned, because of the choice of the "at rest" reference frame, the ground-based atomic clock at the USNO must be in motion at the same velocity as the rotation of the earth at its latitude. This means the magnetic field and gravitational fields of the earth are eliminated from consideration.

To understand what I am talking about, consider that in order for a substance to have caused the H-K data, and in order for this substance, force or field to have "enhanced" (i.e. sped up) the "actual times" of the atomic clocks, the ***faster*** they flew through this substance, it must have two properties. First, for the atomic clocks in the jets, the substance must rotate with the earth. This would work for both the magnetic and gravitational fields of the earth. But for the stationary atomic clock the substance on the surface of the earth would have to rotate the same direction as the rotation of the earth, but move at ***twice*** the velocity as the rotation speed of the earth at that latitude. It would have to fly at twice the speed as the earth because the stationary clock is sitting on the ground, thus if the substance, force or field simply rotated with the earth, the stationary clock would be motionless. Such a substance does not exist.

In conclusion, we can totally eliminate the first postulate of Special Relativity as being of any value. While it is an interesting mathematical observation, it is non-causal and invalid in the real world (even Einstein dropped it by 1920). Ether drag, on the other hand, is logical, causal and is valid in the real world.

It is now time to move on to the five chapters which deal with my two experiments and Lunar Laser Ranging experiments, all of which deal with the "path of light" and the photon theory.

(Note: There is one more section in this chapter that is for those who are concerned there might be some extraterrestrial cause of the H-K data. Most readers can safely skip the next section.)

## Extraterrestrial Causes of the H-K Data

There are two general possibilities for galactic gravity or a galactic magnetic field. The first is that there is an object at the center of the galaxy that creates a gravitational field (or magnetic field) that reaches to the far edge of the galaxy. The second is that galactic gravity (or magnetic field) is simply the summation of the gravity (or magnetic fields) of the stars and other objects in the galaxy. This second option is mathematically illogical, but more importantly can be reduced to a discussion of the sun as our primary source of extraterrestrial gravity or magnetic field, thus it will be ignored as a separate option.

The first option to consider is that the gravitational field or magnetic field (and I use these only as examples to represent many possibilities) is centered at the center of the universe, the center of the galaxy or the center of the sun and it is ***nonrotating***. In this case our earth would be moving through this field at 370 kps, 230 kps or 30 kps, respectively. This option is rejected because these numbers do not fit the Hafele-Keating data, meaning such numbers do not show up in the formulas.

The second option to consider is that the gravitational field or magnetic field is rotating. Data does not support the theory that our universe is rotating. While our galaxy is rotating, whatever object is at the center of the galaxy probably does not rotate once every 225-250 million years (which is the time it takes our sun to orbit completely around the galactic center). Likewise, our sun rotates every 25 days (at the equator), but our earth orbits the sun every 365 days, both counterclockwise (viewing from the North). In both cases the rotation velocity where our sun or earth are located, is not the same velocity as our orbit velocity. This means there is a significant differential between our orbit velocity and the rotation velocity of the gravitational or magnetic field.

Let us suppose for the sake of argument that the difference between the rotation velocity and our orbit velocity was 10 kps. This means that atomic clocks that had angular velocities and vectors that happened to be parallel with our orbit vector at that time, and happened to be moving "***into***" or "headed towards" this rotating field, would measure time very differently than an atomic clock on the opposite side of the earth at the same moment which is moving "***with***" or "in the same direction" as this rotating field. In other words, atomic clocks on opposite sides of the earth would not synchronize with each other due to the 10 kps differential velocity (one would be moving ***into*** the "wind" and the other would be moving ***with*** the "wind"). The difference would essentially be double the rotation velocity of the earth.

Likewise, an atomic clock, stationary on the equator, would speed up and slow down daily as the earth rotated due to this 10 kps difference in velocity (i.e. at times it would be moving ***into*** the "wind" and at times it would be moving ***with*** the "wind"). Again, the difference would be double the rotation velocity of the earth. The differences in atomic times would surely have been noticed and detected by now.

The third possibility is that some substance, force or field creates a stationary bubble around the galaxy or sun, and our earth moves within this stationary bubble. What would this substance be? Undoubtedly it would be ether drag. Whether it is the stationary ether of the universe, a bubble around our galaxy or a bubble around the sun, our earth would be moving through this stationary ether at a velocity of 370 kps, 230 kps or 30 kps, respectively. Michelson and Morley designed their experiment to detect an absolute velocity of the earth of 30 kps through this stationary ether. They got a null result. This possibility was eliminated in the 1880s.

I could go into these issues in more detail or discuss other scenarios, however, the reader should realize that the "at rest" reference frame that worked with the Hafele-Keating data moved with our earth in its motion, and extraterrestrial effects were shielded from the atomic clocks. This makes the possibility that extraterrestrial effects coincidentally caused the Hafele-Keating data ***extremely*** remote.

# Chapter 6

# The Moving Target Laws

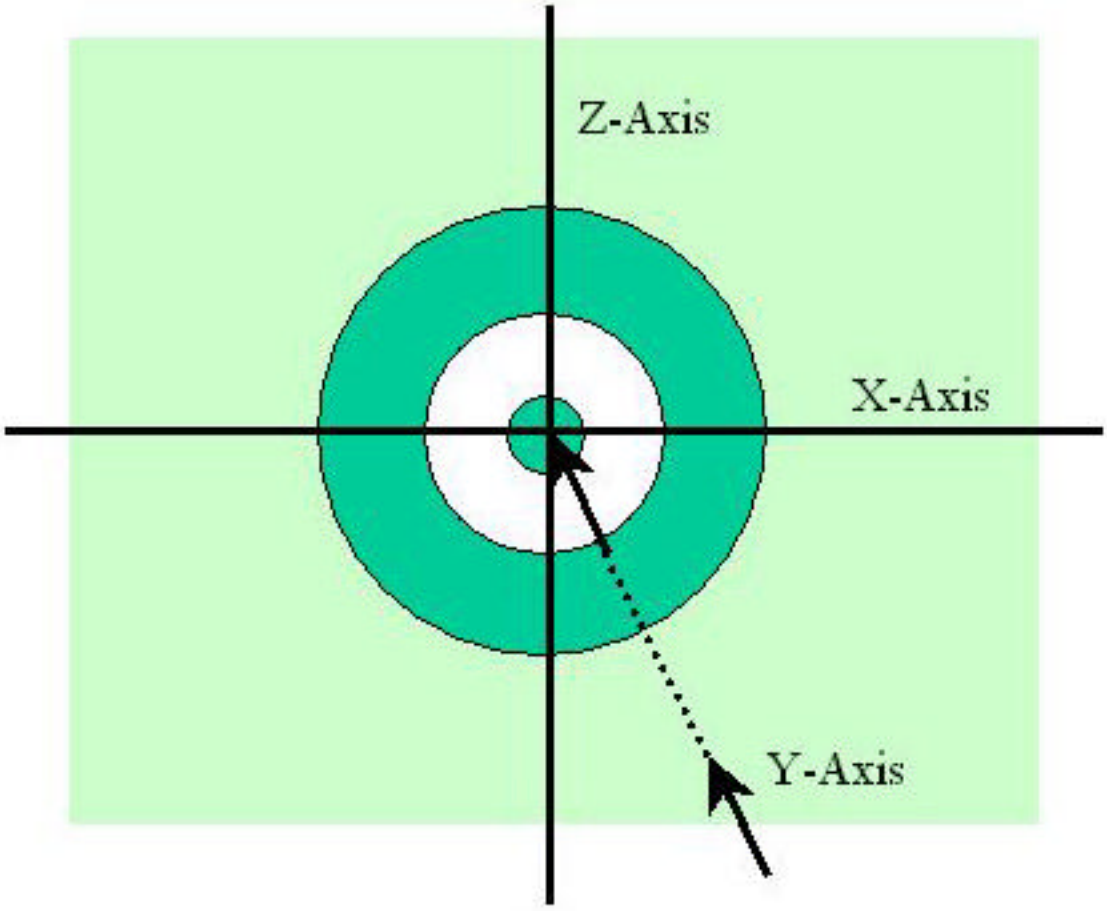
"A ship in port is safe, but that's not what ships are built for."
Grace Hopper. (The computer term "bug" is also due to Grace Hopper)

## Introduction to The Moving Target Laws

When I talk about the "path of light," I am really talking about the Moving Target Laws. It is critical for the reader to have an exact understanding of what the Moving Target Laws are in order to understand any of my experiments or the Lunar Laser Ranging experiments. This chapter will provide that understanding.

Consider an archer who is a perfect shot and always hits the exact center of the bulls-eye. Now consider the archer and his target as a three-dimensional coordinate system. The two-dimensional target is on the X-Z plane. The path of the arrow is the Y axis. The X axis, Y axis and Z axis all meet at a point that is also the center of the bulls-eye of the target. Suppose further that the archer is 100 feet from the target.

See graphics on next page.


Z-Axis
X-Axis
Y-Axis

Now suppose the archer aims at the target and that I am holding the target. Suppose that **after** the arrow leaves the bow, but **before** the arrow gets to the target, two things happen: 1) I move the target one-foot straight up and 2) the archer throws the bow into a trashcan. The arrow will obviously land one foot below the (center of the) bulls-eye. This example, as with all examples, assumes the archer is a perfect shot, there is no arch on the arrow, the experiment is done in a vacuum, etc.

The key to understanding the Moving Target Laws **(MTLs)** is to understand the slice of time between:
1) The instant **after** the arrow leaves the bow and
2) The instant **before** the arrow hits the target.

This slice of time is the time the arrow is **"in the air."** "In the air" means the arrow is no longer attached to the bow, and has not yet hit the target. While the arrow is "in the air," what happens to the archer and the bow is irrelevant because the arrow is no longer attached to the bow. As I implied above, while the arrow is in the air, the archer can throw the bow into the trashcan and this act will have absolutely no affect on where the arrow hits the target. While the arrow is "in the air" the bow and arrow are totally independent of each other.

But the same cannot be said about the target. While the arrow is in the air, it is headed towards the target. Thus any motion of the target, while the arrow is in the air, has a direct affect on where the arrow hits the target**!** This is why they are called the "moving target" laws.

The MTLs basically study the motion of the ***target*** during the slice of time the arrow is in the air. In the example just given, ***after*** the arrow leaves the bow, but ***before*** it gets to the target, the target is moved one-foot straight up. Thus the moving of the target has a direct affect on where the arrow hits the target.

## More Examples of the MTL

If I were to move the target exactly one foot down while the arrow is in the air, the arrow would land one foot above the (center of the) bulls-eye. If I move the target exactly one foot to ***my*** right (while the arrow is in the air), which is to the archer's left, the arrow would miss the target by exactly one foot to my left. I am behind the target so the arrow would hit to the left of the bulls-eye from my perspective. But from the archer's perspective, the arrow would land to the archer's right (i.e. the archer would see the arrow land one foot to the right of the bulls-eye). And so on.

Now let us do thousands of these exercises. Suppose that after the arrow leaves the bow, that I am allowed to move the target exactly one foot on the two-dimensional X-Z plane, and that I can move the target in any of the 360 degrees of the plane. If we were to do this exercise thousands of times there would be up to 360 holes that would form a perfect circle (i.e. the holes would all be on the outside edge or perimeter of the circle), with the center of the bulls-eye being the center of the circle. No holes would be inside or outside of the perimeter of holes.

Now let us construct an imaginary three-dimensional sphere with the center of the sphere being the center of the bulls-eye. The imaginary sphere has a radius of exactly one-foot. Now let us change the rules. I can move the target exactly one foot while the arrow is in the air, but I can move it in any direction in three-dimensions, as long as the center of the target ends up being on the surface of the imaginary three-dimensional sphere when the arrow arrives.

In other words, the center of the bulls-eye will always be on the surface of the imaginary sphere by the time the arrow arrives. Since the sphere is in three dimensions, but the target is only in two dimensions, I can move the target such that the arrow can hit any point within a one-foot radius of the center of the bulls-eye.

As an example, if I were to move the target along the Y-Axis, directly towards the archer or directly away from the archer, ignoring the arch of the arrow, the arrow would hit the center of the bulls-eye even though I moved the target one-foot. If I were to move the target slightly off of the Y-Axis, the arrow would just miss the bulls-eye.

Now suppose this three-dimensional experiment were done thousands of times and I moved the target randomly. In this case an imaginary circle of one-foot radius on the target, with the bulls-eye at the center, would have many arrow holes in it or on its perimeter. In other words, instead of just being on the perimeter of the circle, the holes would also occupy the inside of the circle.

Now suppose we studied one specific hole in the target. Let us suppose that I moved the target one-foot at such an angle on the sphere that the arrow missed the center of the target by exactly 5 inches. Studying the angle that the hole is from the bulls-eye, the angle that I moved the target could easily be determined. However, since the target itself has only two-dimensions, it could not be determined whether I moved the target generally towards the archer or generally away from the archer (on the Y-Axis). Thus the solution to exactly how I moved the target in three-dimensions could only be reduced to two possibilities.

If an observer were standing on the side of the target, she could note whether the target were moved forward or backwards because she would see the Y-Z axis.

Thus she could determine the Y-Axis movement and narrow the possibilities down to one.

## More Complex Archer Examples

Now let us suppose that I am standing on a flatbed car on a moving train. Again, I am holding the target. We will assume the archer is standing on a train station platform. The flatbed car is moving with the train (along with the target), but the archer is not moving. Let the distance between the archer and the target be 100 feet.

Let us assume that the train is moving at such a speed that in the time it takes the arrow to travel to the target the train moves exactly 1 foot (the train is in constant motion). Now suppose the archer lets go of the arrow at the exact instant that the bulls-eye passes him. Now suppose that I do not move the target, but hold it still. The arrow will again miss the target by 1 foot. If the train is moving left to right (per the archer), the arrow will land to the left of the bulls-eye by 1 foot.

If additionally I had moved the target one-foot in the direction the train is traveling, the arrow would miss the bulls-eye by 2 feet. It would miss the bulls-eye by 1 foot because of my moving the target and another foot because of the moving train.

However, if I moved the target in the opposite direction the train is traveling, the arrow would hit the center of the bulls-eye. The 1-foot miss caused by the motion of the train would be offset by the 1-foot miss caused by my moving the target.

In these cases the ***platform*** that the target is standing on (i.e. the flatbed car) is in motion, thus the motion of the platform has a direct affect on the motion of the target while the arrow is in the air. The MTLs apply both to my movement of the target, and to the platform's movement of the target. Anything that moves the target while the arrow is in the air is significant to where the arrow hits the target.

In the experiments that are discussed in future chapters, the platform will be the earth, the archer will be a laser, and the arrow will be a laser beam.

One of the hardest things for people to grasp about the moving target laws is that once the arrow or laser beam is "in the air," the motion of the archer or the motion of the laser is irrelevant. People constantly wonder why the motion of the archer or laser is irrelevant. Many examples will be given to make this distinction clear.

The MTLs will be mentioned many times in this book. They are not only the basis of aberration of starlight, but are also directly involved with all of my experiments and any experiment that involves the path of light.

# Chapter 7

# Secular Aberration

"It is not an optical illusion, it just looks like one."
Phil White

## Secular Aberration and the MTLs

Secular aberration will now be revisited with respect to the MTLs. Aberration of starlight is a phenomenon that requires telescopes to be tilted slightly in order to track stars, but why do telescopes need to be tilted? There are actually two ways to describe why they need to be tilted.

Suppose there is a train that is traveling at 50 kph (kilometers per hour) under a bridge. On this train is a flatbed car that has a tall, thin bucket standing in the middle of this car. As the train goes underneath the bridge, someone who is standing on the bridge drops a drop of water such that it enters the exact center of the top of the bucket. Because of the motion of the train, this same drop of water will not hit the center of the bottom of the bucket. The bucket is attached to the train and the train is moving while the drop of water is moving down the bucket. In order for the drop of water to hit the center of the bottom of the bucket, the bucket must be tilted. If this train, on the next day, was traveling in the opposite direction, the bucket would need to be tilted in the opposite direction.

Note that the drop of water and the bucket/train entity move independently of each other. The drop of water is never "carried" or "dragged" with the train or the bucket.

The second way is to talk about rain and cars.

When we drive down the highway during a rain storm, even if the rain is coming straight down, it appears to the driver that the rain is coming down at an angle. This is an optical illusion. CCD chips that are used in telescopes are not subject to this kind of optical illusion because they only see starlight when it hits each pixel, and they see nothing until this light beam hits the CCD chip. The reason a person is confused is because he or she sees the light ***before*** it hits the windshield. Thus, the tilt of aberration of telescopes is not caused by the same kind of optical illusion as people encounter while driving in the rain.

To understand why aberration is an application of the MTLs, consider that the earth is orbiting the sun, and the target (i.e. the bottom of the telescope) is attached to the earth (the platform), just as the bucket above is attached to the train. Thus the target is moving around the sun with the earth at 30 kps. A tilt of the telescope is required so the light that hits the center of the top of the telescope also hits the center of the bottom of the telescope. Since the 1700s scientists have used aberration of starlight as evidence of the velocity of the earth in total space, because they felt the sun was at rest in the universe.

But now we know a lot more about the universe. We now know that our earth's total velocity in space is 370 kps. Suddenly, we know that the actual tilt of aberration of starlight must be based on our total velocity in space of 370 kps. To be more specific, it is based on our range of velocities from 340 kps to 400 kps.

Since the tilt for secular aberration is constant for a given star, and always causes telescopes to be tilted in exactly the same direction, we cannot isolate this tilt. We can only measure the tilt caused by our variable velocity of 340 kps to 400 kps.

The main point to this discussion is that because the bucket and drop of water are independent of each other, we can therefore conclude that photons (assuming they exist) move independently of the telescope (i.e. they are not dragged with the telescope), and thus independently of the earth. This observation, in fact, was one of the key arguments against the ether drag theory of light. To put it another way, the path of a photon, once in motion, moves relative to the 3D CMBR of the universe, totally independently of the earth in its motion in the 3D CMBR of the universe (i.e. the photon, unlike air, is not dragged with the earth). If it were not for this, there would be no aberration of starlight with the photon theory.

Before moving on another metaphor would be helpful, “The Glowing Suit Metaphor.”

## The Glowing Suit Metaphor:

Let us consider a train that is traveling at 370 kph in a vacuum, meaning we can ignore all types of wind. The train tracks are straight. One of the cars on this train is a flatbed car that has a table on the middle of it. A person is running in circles around the table on this flatbed car at 30 kph, 3 meters from the table. The running person is carrying a tall, narrow bucket.

As this person runs in circles around the table, note that the table is always traveling at a perfectly constant velocity of 370 kph towards the train's destination. This means the person, if he were standing still, would also be

traveling at a constant 370 kph down the train tracks. However, the person is not standing still. When he happens to be running in the same direction as the train, his total speed is 400 kph, ***relative to the ground***, 370 kph from the motion of the train plus 30 kph from his motion running around the table. When he happens to be running in the opposite direction the train is headed, he is running at 340 kph, ***relative to the ground***, 370 kph from the motion of the train minus 30 kph from his motion running around the table.

Image, for a moment that the table and the suit of the running person glow very brightly in the dark. Imagine that astronauts in space are looking at this train at night and they can only see the glowing table and the glowing suit of the running person. These astronauts would see the glowing table traveling in a straight line at a steady 370 kph. They would also see the glowing suit moving in an almost straight line, but not at a constant speed. They would probably think that the two objects were in a race down a highway. The glowing suit would travel in nearly a straight line, but it would slow down and speed up and at times would be in front of or behind or on different sides of the table. The astronauts would be very puzzled, particularly if they could not see the table (try to visualize that!).

Now consider two people that are standing far above our galaxy. The "***ecliptic plane***" is the 2D (2 dimensional) plane in space defined by the sun at its center, and by the orbit of the earth. In other words, the earth orbits the sun on the ecliptic plane by definition. The 12 zodiac constellations are all on the ecliptic plane, including Leo, the constellation we are headed for. Let us assume these two people are normal (i.e. perpendicular) to the infinitely wide ecliptic plane, but are totally stationary relative to Cosmic Microwave Background Radiation (CMBR). Suppose they stood in the same spot for a thousand years, and could only see the virtually linear motion of our sun and the motion of our earth in the cosmos (i.e. they could not see anything else in our galaxy). They would see almost exactly the same thing the astronauts just described would see from space.

If they could measure the velocities of the sun and earth they would note that the sun is moving at a constant 370 kps in a linear direction, but they would also note that the earth is not moving at a constant velocity. At times the earth is moving at 340 kps, at times it is moving at 400 kps (because it is going in circles around the sun), and at most times it is moving at some velocity between these two extremes. As with the astronauts, these observers would think that there was a race between our sun and our earth. At times the earth would be in front of the sun and at times it would be behind the sun in this race. At times it would be moving faster than the sun, and at times it would be moving slower.

Just because we don't "see" our 370 kps average linear speed in the cosmos on a daily basis (this is because of our "slow" speed relative to the vastness of the Universe) does not mean it is not happening. For many centuries before Kepler, no one believed our earth was rotating or that it was orbiting the sun. Their

belief, no matter how popular or how sincere, did not stop our earth from rotating and orbiting the sun - and heading towards Leo. Between the time of Ptolemy and Kepler, the earth continued to rotate and orbit the sun and move with the sun towards Leo at 370 kps.

The important point to make with this metaphor is that the sun is traveling at a virtually constant velocity towards Leo (this is why secular aberration is generally ignored in celestial mechanics calculations), but our earth's velocity towards Leo varies from 340 kps to 400 kps, depending on where we are in orbiting the sun, relative to our joint path towards Leo. Since Leo is on the ecliptic plane, the above example is very accurate.

## The Bucket

Now lets talk about the bucket the running man is carrying. Suppose that high above the train and train tracks is a long pipe. On this pipe are occasional buckets that are full of water and each has a small hole in their bottom. The water is dripping slowly out of each of these buckets. These buckets are not moving, meaning each drop of water reaches the train perfectly vertical. Suppose each water drop hits the top of the bucket at the exact center of the top of the bucket, no matter where the running man is in his circular running around the table.

When a water drop hits the center of the top of the bucket, the train is moving at 370 kph and the running man is running at 30 kph. As just mentioned, the relative velocity of the running man to the ground varies between 340 kph and 400 kph. This means that the bucket is also moving at this range relative to the drops of water that are coming down. This is because the pipe is not attached to the train, it is attached to the ground. Thus, in the time that it takes the drop of water to travel from the top of this long, thin bucket (that is being carried by the man), to the bottom of the bucket, the bucket is moving with the train and running man. No drop will hit the center of the bottom of the bucket.

Because of the MTLs, in order for each drop to hit the center of the bottom of the bucket, the bucket will have to be tilted. However, because the man is running in circles around the table, his velocity is changing and the tilt of the bucket will need to be constantly changed, depending on where he is relative to the table at the time a drop of water hits the top of the bucket.

In a similar way, the tilt of aberration of starlight varies between 340 kps and 400 kps. It is this variance that is measurable and is caused by our earth's orbit velocity around the sun (remember this discussion is pertaining to the photon theory). We don't really care about the motion of each star or galaxy, what we do care about is the angle of this light relative to the telescope.

Note that with the running man, the tilt of the bucket is always based on two factors: first, the constant speed of the train, and second, the variable speed of the running man. If we were to measure only the ***change*** in the tilt of the bucket (and ignore the constant or absolute tilt caused by the train's motion), the change would only be caused by the variable speed of the running man. In other words, no part of the change is caused by the train's motion, because the train's motion is constant. The change in the tilt would be caused exclusively by the motion of the running man.

Likewise, with light, aberration of starlight is always based on two factors: first, the constant velocity of our solar system towards Leo at 370 kps, and second, our earth's orbit velocity around the sun at 30 kps. As with the running man, if we were to measure the ***change*** in the tilt of aberration (and ignore the absolute tilt caused by our solar system's motion towards Leo), the change would only be caused by the variable speed of the earth around the sun. No part of the change would be caused by secular aberration because secular aberration is constant. Thus, the USNO dictionary is quite right, secular aberration can justifiably be ignored.

The key point to all of this, and the point the reader needs to absorb, is that with the photon theory, ***actual*** aberration of starlight always includes our 370 kps motion towards Leo. There is absolutely nothing in the photon theory to challenge or contradict that secular aberration is actually observed, no matter what the source of light is.

If we think about the bucket mentioned above being horizontal, instead of vertical, and if we think about the water source as being in front of the train, little tilt would be needed for these drops. In other words, stars on or near the ecliptic plane have far less secular aberration or stellar aberration than stars normal to the ecliptic plane. But this does not negate that secular aberration exists for these stars, it simply means that because of their location much less tilt is necessary (i.e. the lack of tilt is not because of the lack of secular aberration, it is because of the angle at which the light arrives relative to our ecliptic plane or to be more accurate for secular aberration - the plane of our path towards Leo).

So why can't we measure the absolute tilt of aberration? We could if we knew where a star really was. But we don't know where any star really is, we only know where each star ***appears*** to be. We "see" the star in our telescope, and we think we know where it actually is, but in fact we don't know where that star is really located.

The scientific community is willing to ignore knowing where stars are actually located because it is impossible to determine where they really are. In fact we will never know their exact location because there may be many other factors that affect the light between the star and our tiny planet.

Has the total 370 kps tilt of aberration ever been isolated and proven to exist? The answer is ‘no’ because we don’t know where the stars really are, thus we have no basis for calculating actual aberration. The term "secular aberration" was invented because our true 370 kps average velocity towards Leo ***must be accounted for*** in terms of aberration, no matter whether the photon theory or the ether theory is true. But the two theories account for secular aberration in vastly different ways, as will be seen as the book progresses.

In reality, it should be very easy to detect and isolate secular aberration, simply use terrestrial light, but things are rarely as simple as they seem.

With the ether drag theory, why is there any aberration of starlight? Late in this book there will be an entire chapter on aberration of starlight and ether drag. The conclusion of this chapter will be that aberration of starlight occurs at the boundary (i.e. the outside surface) of the ether drag. There are two different ways this can occur, but they will be mentioned later. This means that if the sun's ether drag extends beyond the orbit distance of the earth, that the 370 kps secular aberration actually occurs at the boundary of the sun's ether drag, millions of miles from earth. Only the 30 kps stellar or annual aberration occurs at the boundary of the earth's ether drag. In other words, with the ether drag theory, the total aberration of starlight is broken into two pieces, if the sun's ether drag extends beyond our orbit distance. A future chapter will detail this.

# Chapter 8

# My First Experiment

"The most exciting phrase to hear in science, the one the heralds new discoveries, is not 'Eureka!', but 'That's funny'."
Isaac Asimov (1920-1992)

## The Detection of Ether

Even though in this book the Hafele-Keating experiment was discussed before my experiments, which will now be discussed, in reality it was my discovery of ether drag in 1998 and 1999 that attracted my attention to the Hafele-Keating experiment.

As mentioned in Chapter 1, the debate between ether and photons can be traced back to Sir Isaac Newton. Prior to Newton, there were several different theories about what light is. After Newton there were only two, and the particle nature of light (then called a "corpuscle") was the accepted theory of light. In the early 1800s, the corpuscle theory of light was disproven (it failed to correctly predict refraction). Also, Young's dual-slit experiment demonstrated that the wave nature of light was profound. These two discoveries, and others, combined to turn scientific opinion to the wave theory of light - the aether or ether theory of light. Then, for a variety of reasons, but mainly because of a second round of Compton experiments, the ether theory was dropped in 1924.[22]

Note that the changes back-and-forth between the wave theory of light and the particle theory of light have always included some experiment that indicated the "wave" or "particle" nature of light was "***stronger***" than believed at the time. The best solution to determining what light is, is ***not*** to use the "wave" or "particle" nature of light, because light clearly has both properties.

In November of 1997, I gave a two-hour presentation to the Chief Scientist of the large telecommunications corporation where we both worked. I wanted $16,000 to buy some equipment for Phase 1 of a series of experiments designed to isolate why the frequency of fiber optic signals drifted in and out of phase over time. I told him that I thought the problem was caused by our earth's total motion in space, now known to be 370 kps.

Because I could not believe that a burst of energy (i.e. an electron quantum drop) could be converted into a very complex particle (a photon), as easily as everyone said it could, I made it clear to the Chief Scientist that I thought ether probably

existed. For this, and other reasons, I designed Phase 1 of the experiments to determine whether ether existed. He carefully listened, but he did not approve any funding.

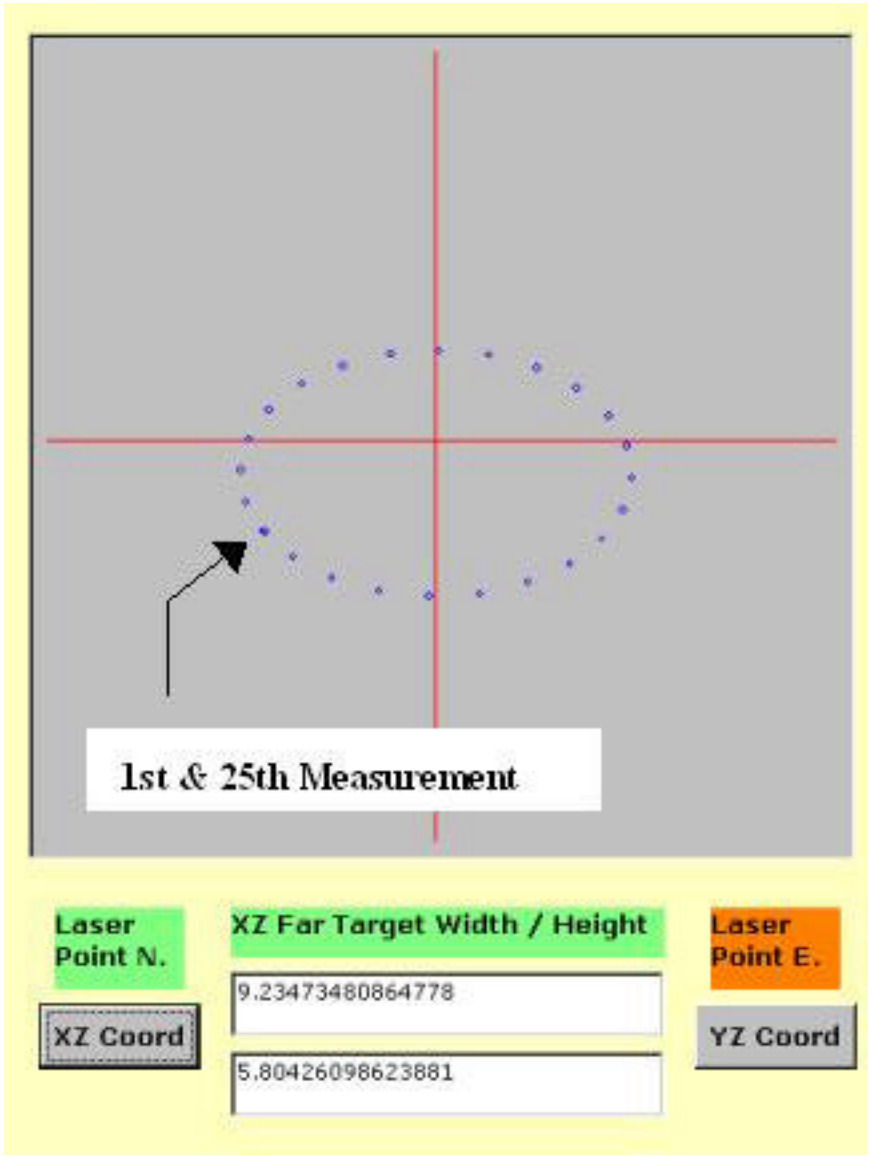
Several months after my failed attempt to get funding I heard about Roland De Witte. Roland had done some experiments in Belgium in 1991 that I had never heard of. When Roland sent me a description of his experiments, I forwarded his email to the Chief Scientist without additional comment. He understood the significance of Roland's discovery.

Roland's experiments had proven that the earth's motion in space caused a drifting in the frequency of electrical signals over time. Roland detected frequency changes that had a sinusoidal cycle, with a ***sidereal day period***, for 178 consecutive days (I will explain all of this in the chapter on the De Witte experiment)**!** Roland's proof that the earth's motion in space affects frequency changes is exactly what I had predicted for fiber optic signals. Roland had used the pattern of frequency changes to detect a URF, the same URF that is also called CMBR, and his experiment roughly estimated our planet's total velocity in space. One or two days after I forwarded the email from Roland, I got a call from a manager in the Chief Scientist's department asking me how much money I wanted for my experiments.

My approach to detecting ether in Phase 1 had to do with the Big Bang. I felt that because ether particles were much lighter than atoms, that the expansion of the ether after the Big Bang was significantly faster than the expansion of the visible universe. I knew this expansion would slow down over time, and the process of "thinning out" the ethons would slow down, but I felt it's expansion was still faster than our very heavy solar system. Because I did not believe in ether drag at that time, I had several ideas on how to directly detect the much quicker expansion of the ether, all of which involved detecting the bending of light on the surface of the earth.

As part of this effort I built some computer simulations which were composed of a number of celestial mechanics formulas, coupled with the direction I intended to point my laser continuously over a 24-hour period. For several months we did experiments, but we were never able to get the actual experimental results to agree with the computer simulations. By plotting where the laser beam hit a target over the time period of 24 hours, I was looking for a distorted ellipse caused by the bending of light, but I could not get an ellipse, much less a distorted ellipse.

See the graphic on next page for an example of a computer generated non-distorted "ellipse" on a target.


1st & 25th Measurement
Laser Point N.
XZ Far Target Width / Height
Laser Point E.
9.23473480864778
XZ Coord
5.80426098623881
YZ Coord

Each of the 25 dots on the target are made by physically marking the target (this is a computer simulation), once an hour, and the dot is put where the laser beam hits the target. The first and last dots are taken at the same time on consecutive days and thus are on top of each other. The width of the above ellipse is predicted to be about 9.2 inches (in this hypothetical experiment) and the height of the ellipse is predicted to be about 5.8 inches. This hypothetical experiment was done at about 39 degrees north latitude with the laser pointed north, thus the ellipse is really a circle tilted at 39 degrees.

More will be said below about why I was expecting an ellipse.

We kept changing the equipment in order to make our equipment more stable. Then one morning at about 6:00 AM, at an experiment site during an experiment, it hit me like a bolt of lightning: "I was not going to get an ellipse, when everything worked I was going to get a "***dot***" (i.e. all 25 points were going to be on the same spot), all of the data we were getting was caused by weaknesses in the stability of our equipment**!**" Over the next 45 minutes I wrote about 10 pages of notes on the ramifications of getting a dot instead of an ellipse. I described an "Ionospheric Balloon" of ether and how this Ionospheric Balloon did not rotate with the earth, and many other things. I then understood why I wasn't getting any usable results from my experiments.

Within a period of a few seconds I became a believer in "ether drag" (though I am not sure whether I knew of that term at the time), and I knew I was not going to be able to detect the expansion of the Big Bang from the earth's surface because ether drag was shielding the data I was looking for.

Prior to this time we had already switched from using a laser to using a telescope (Note: This experiment can be done with a laser, but because of beam divergence, it is more accurate to use a telescope.), but I realized the telescope I was using was not powerful enough to analyze the very small movement of a dot on a paper target. We rented a telescope from a science teacher, and on our first attempt we got a dot. The movement from the dot on the computer screen (i.e. the motion of the point on a piece of paper, from the initial point, recorded by our CCD camera) was random and the maximum movement of the dot was only 5% of the motion of what the original predicted ellipse would have been.

In a nutshell, what I discovered is this: "***if ether exists, so does ether drag***!" Since I already believed in ether, this meant to me that ether drag existed. However, even for those who do not believe in ether, it meant that if ether exists, so does ether drag. If there were no ether drag, and if ether existed, I would have gotten an ellipse due to the motion of our earth towards Leo**!** The fact that I got a dot is proof that if ether exists, so does ether drag. This might not seem like a major discovery, but it eliminates one of the possibilities in the ether-photon

debate**!** It means that we do not need to consider the possibility that ether exists without ether drag.

Because I was dealing with the "***path of light***," instead of the speed of light, and because I wasn't dealing with half-silvered mirrors, frequency shifts, or interference patterns, there was only one way to interpret my results. This one discovery opened the window to experimentally separating the ether theory from the photon theory ***without using the particle or wave nature of light as the determining factor***. My "null" result (a "dot" instead of an ellipse) was not really a null result at all, I had clearly detected the ether drag if the ether theory of light is true**!** So had Michelson and Morley in hindsight. Using simple logic, this means that ***we don't need relativity to explain the null result of the Michelson-Morley Interferometer experiment***.

## The Photon Perspective

Thinking back to the photon theory, aberration of starlight is proof that photons travel independent of our earth's motion towards Leo (assuming photons exist). It doesn't matter whether the light is from a star, the moon, or from across the room - photons are not dragged with the earth. It would be absurd to think that photons from distant stars are not dragged with the earth, but photons from terrestrial lasers are dragged with the earth.

The fact that photons move independent of the earth is one of the key reasons the ether theory was rejected, because ether drag does drag light with the earth, but photons don't. By using the "path of light," meaning the path of a laser beam or the path of light from a target to a telescope, ***it is possible*** to determine whether light travels by photons or ether, if we know that if ether exists, so does ether drag**!** This is because there is a vast difference in the path of light between the photon theory (photons are not dragged with the earth) and the ether drag theory (in which light is dragged with the earth), ***using terrestrial light sources, which are entirely inside of the ether drag***.

To put it yet another way, if the photon theory is true, the total aberration of starlight (based on our total 370 kps motion towards Leo) could easily be detected ***using terrestrial light*** because photons are not dragged with the earth**!** But if the ether/ether drag theory is true, this aberration of terrestrial light will be virtually zero because the light signals will be dragged with the earth! ***Thus it is easy to make the final determination of whether ether or photons exist - determine the aberration of terrestrial light***!

Unfortunately, I have never had access to equipment that could make that determination directly, so I have had to jury-rig different kinds of experiments that ran into complication after complication. I ultimately had to determine that terrestrial light does not have aberration by experimentally detecting

phenomenon that led to paradoxes rather than a direct observation. This actually had some unexpected advantages, but it would be nice to directly detect it some day. I will now start the process of explaining what I did and why I did it.

## Applying the MTLs to My Experiments

In the case of a terrestrial light source, the platform the target is on is the earth. For example, suppose the earth is headed towards a specific spot in the constellation Leo at exactly 370 kps. Suppose a laser is aimed exactly perpendicular to our vector towards Leo and suppose that a single pulse of the laser is fired towards a fixed target 300 meters away.

Both the laser and the target are attached to the earth, and both are headed towards Leo at 370 kps. What happens when the laser is fired, and the laser beam exits the laser barrel? To understand what happens, let us think about two spaceships traveling side-by-side at 370 kps, 300 meters apart, both headed towards Leo. The laser is on one of the spaceships and the target is on the other spaceship. Once the laser beam is "in the air," meaning it has left the barrel of the laser and is traveling towards the target, we can instantly ignore the motion of the spaceship the laser is on. Understanding why the spaceship the laser is on becomes irrelevant once the laser beam leaves the laser is the ***whole point*** of the MTLs**!**

Once the laser beam is in the air, we focus our attention on the motion of the target (i.e. the spaceship the target is on), and ignore the motion of the laser (i.e. the spaceship the laser is on). What will happen? The laser beam will miss the center of the target because the spaceship has moved at 370 kps towards Leo while the laser beam was in the air.

Exactly the same thing would happen if both the laser and the target were on the earth. In other words, it doesn't matter whether the laser and target are on separate space ships or whether they are both on the surface of the earth, the MTLs apply exactly the same.

The speed of light is about 300,000 kps. The velocity of the earth is about 370 kps. Thus, the velocity of the earth is about 0.001233 of the speed of light. So if the laser beam travels 300 meters, for example, the target travels about 0.37 meters towards Leo while the laser beam is "in the air**!**" This means the laser beam should miss the center of the target where it was originally aimed by about 0.37 meters**!**

But now there is a problem, it is impossible to determine exactly where the laser was originally aimed because light is also traveling from the target to the laser (i.e. from the target to the eyes of the person aiming the laser), and for this light the laser (i.e. the eyes of the person aiming the laser) is the moving target. To

overcome this paradoxical problem, it is necessary to build a computer simulation program that can, from the spot the laser beam hits the target, calculate where the laser was originally aimed. But, by itself, this doesn't prove anything because it requires several assumptions. To overcome making any assumptions, the experiment needs to be done continually over 24 hours. How this avoids making assumptions requires some visualization, which will also help understand the MTLs.

## The Toothpick / Globe Exercise

To visually understand my experiments, tape a toothpick (pointing north) to a globe, say at 40 degrees north latitude. (Warning: Do not use a type of tape that will tear the globe's surface.) Also place a string tightly between the center of the bottom of the globe stand and the edge of the table the globe is on (i.e. it must be straight). The toothpick represents the vector of the laser beam. The string represents the vector of our earth towards Leo.

Now spin the globe very slowly and note the continuously changing angular relationship between the toothpick (i.e. which represents the path of the laser beam, the laser is not touched during the experiment) and the string (i.e. which represents our earth's path towards Leo). The earth is almost uniformly moving towards Leo, but the earth's rotation causes the laser beam (the toothpick) to change angles continuously relative to our path towards Leo (the string), which never changes during the exercise. Spin the globe several times very slowly. In the time the laser beam is in the air, the earth moves along the path of the string. The toothpick is constantly changing angles, but the string never changes its direction.

Now lets simulate the actual experiment with the globe. Put a "target" at the north end of the toothpick (the target should be about 5 cm wide). The target, a small piece of cardboard, should be normal (i.e. perpendicular) to the toothpick, and its center should be touching the toothpick. Attach or tape the target to the globe. Now ***untape*** the toothpick from the globe. This is because the laser beam will not travel with the earth towards Leo, only the target will move with the earth. Hold the toothpick with your fingers and point it to the center of the target. Put a mark on the cardboard where the tip of the toothpick is touching the target.

Now imagine that the laser is fired. Move the globe 2 cm towards Leo (i.e. towards the edge of the table along the string). Hold the toothpick in place with your fingers and do ***not*** move the toothpick as you move the globe. In other words, the toothpick must remain fixed ***relative to the table*** while the globe is moved. The 2 cm represents the motion of the earth towards Leo ***while the laser beam is "in the air."*** Since the target is taped to the globe, it obviously moves with the globe. The motion of the target is significant because the beam has not yet hit the target.

Note, do not rotate the globe as you move the globe along the string. The velocity of the rotation of the earth is so slow, relative to the speed of light, that the earth's rotation is totally irrelevant to this experiment. Any rotation of the globe as you move the globe along the string will throw off this demonstration.

Since the toothpick is not attached to the globe, and you are holding it motionless in the air, relative to the table, the toothpick will not move towards Leo with the globe. When you have stopped moving the globe 2 cm, the tip of the toothpick will not be touching the target at the same place it was touching the target before the globe was moved. Now mark the spot where the laser actually hits the target. You will now have two marks on the cardboard, the center and one mark after moving the globe.

Now continue to do the experiment for 24 simulated hours by doing the following:
1) Rotate the globe 15 or 30 degrees without moving it along the string.
2) Before moving the globe along the string, ***reset*** (i.e. realign) the north tip of the toothpick with the center dot on the target (i.e. every time before moving the globe along the string, move the toothpick to the ***original*** spot on the target and at the original North angle relative to the globe - this is critical), and then
3) Move the globe exactly the same distance in the direction of the string as before (do not move the toothpick with the globe and do not rotate the globe as you are moving it along the string), and then
4) Mark each spot after you move the globe along the string, and then
5) Repeat the first four steps until you have completed rotating the globe (i.e. until you have simulated 24 hours).

You should see a pattern develop that looks like a very crude ellipse.

Especially note that half-way through the exercise, after rotating the globe 180 degrees (i.e. for 12 hypothetical hours of earth's rotation), the new dot is on the opposite side of the center of the target than the first dot was. Note also that the tips of the toothpick have effectively switched places at this 12 hour mark. Ponder these things because they will become very important in the next chapter.

Each mark represents what happens if a laser beam is fired at a target. The target moves with the earth towards Leo. But aberration of starlight (via the photon theory) tells us that the laser beam will not move with the earth towards Leo. After the photons are "in the air," the photons will move in a straight line relative to CMBR (the table), and will not be dragged with the earth. Since the angular relationship is continually changing between our path towards Leo and the path of the laser beam (because of the rotation of the earth), the "miss" of the laser beam will continually change.

In other words, suppose the laser beam were fired 25 times, once an hour, where the first and last firing would hit the same spot (well, not exactly, the first and last spots will not be exactly the same spot because the earth is orbiting around the sun, but it should be very close). The laser beam would hit the target in 24 different places. This is because the rotation of the earth constantly changes the angular relationship between our vector towards Leo and the vector of the laser beam. If fact, if we marked these 24 different positions, they would form an ellipse (see the graph earlier in this chapter). The ellipse would actually be a circle tilted at 40 degrees (which is the latitude of the laser).

This is the key: in my experiment I did not need to know where the laser was originally pointed. All I needed to do was plot the 25 firings of the laser and the center of the ellipse (i.e. the center of the tilted circle) would be where the laser was actually aimed during the experiment.

## The Actual Experiment

In my first experiments, I shot a laser at a target 300 feet away (and other distances in other experiments). In the time it took the laser beam to hit the target, the earth (and thus the target) moved about 4.44 inches (in 3D) towards Leo (i.e. 0.37 of one foot). Since the motion of photons (as always, assuming the photon theory) and the motion of the earth are independent, I should have missed the target by 3.6 inches (in 2D) because of the MTLs.[23] The reader might think that the correct answer would be a 4.44 inch miss, and it would always be a 4.44 inch miss in 3D. But remember that the experiment is being done at 40 degrees north latitude (actually it was closer to 39 degrees north), thus the maximum 2D miss is not equal to the constant 3D miss. Actually, the 3.6 inch number was obtained with a considerable amount of celestial mechanics formulas and represents the maximum "miss" (in 2D) over the 24 hours in any direction at about 39 degrees north latitude.

In order to avoid many complications (such as knowing where the laser beam was "really" pointing) I did two things. First, I used a computer simulation and celestial mechanics formulas to determine the exact vector of the laser beam to our earth's vector towards Leo at any given time. This allowed me to project the 3D "misses" of 4.44 inches to a projected maximum 3.6 inch "miss" in 2D. Second, and most important, I did the experiment continuously over a 24-hour period (one complete rotation of the earth), as already explained.

The purpose of this experiment was to determine if there is secular aberration of terrestrial light with a tilt of aberration of 370 kps. Because photons are not dragged with the earth, in the time it takes the laser beam to travel from the laser (i.e. think about the photon hitting the center of the top of the telescope) to the target (i.e. think about the photon missing the center of the bottom of the telescope because of the earth's motion in space), the photons will miss the spot

the laser was actually aimed at. Since we don't know exactly where the laser was aimed, we must do the experiment for 24 hours and use the pattern to determine where the laser was aimed.

With the photon theory of light, the markings on the target should have been a nearly perfect ellipse, just as if the ether theory were assumed without ether drag. With the photon theory, because the photons do not move with the earth towards Leo, the full effect of secular aberration should be manifest in the markings on the target.

So what were my experimental results? Once I got my equipment completely stabilized, in both laser experiments and telescope experiments, all 25 markings were essentially the same spot. In other words, I did not get an ellipse, I got a single dot, with very minor noise. This amounts to a null result. This is why I thought I had detected ether drag.

Before going any further, I now need to talk about "path momentum."

## Path Momentum:

Now let us consider another example of the MTLs. Suppose there are two parallel train tracks and two trains running "nose-to-nose" at the same velocity. Suppose the archer is on one of the train's flatbed cars and that I am holding a target on a flatbed car on the other train. We are directly across from each other. If the archer shoots his arrow, and if I do not move the target, it is well known that the arrow will hit the center of the target. However, this success is actually the result of two offsetting laws.

If the archer were standing on a stationary platform, and the train the target is on was moving to the archer's right, the arrow would hit to the ***left*** of the target due to the MTLs. On the other hand, if the archer was on a moving train and the target were on a platform, the arrow would hit to the ***right*** of the target due to the momentum of the arrow. But in the case we are discussing, both the archer and the target are on moving trains, thus the MTLs and momentum offset each other and the arrow hits the center of the target (this, of course, assumes no air, etc.). I call the type of momentum that the arrow has: **"path momentum,"** to emphasize that the momentum of the arrow affects the path of the arrow.

Relative to the archer, the arrow does not leave the bow at an angle because the archer is moving with the train and he does not see the angle. However, the archer's perspective, as always, is ***irrelevant*** to the MTLs. The MTLs are always concerned with absolute motion, meaning motion relative to a fixed, unmoving coordinate system, meaning the ground in this case. Relative to the ground (i.e. if we took a moving picture from a fixed platform high above the trains, the arrow leaves the bow ***at an angle***. In other words, the archer thinks the arrow goes

straight, just where he aimed it. But in fact the arrow leaves the bow at an angle, relative to the ground.

Getting back to my experiment, there is one difference between using terrestrial light and star light. With terrestrial light there are variables we have to deal with concerning the nature of the light source. In other words, the light leaving the laser may have path momentum, which is something that is irrelevant for starlight. If photons did not have path momentum, clearly the pattern I got would have been an ellipse because photons are not dragged with the motion of the earth. Thus, ***if photons exist, because I got a single dot instead of an ellipse, photons must have path momentum***.

In other words, relative to CMBR (which is our coordinate system in all photon examples), if photons have path momentum, the photons leave the laser ***at an angle***. If they didn't leave at an angle I would not have gotten a dot. We would not observe this angle because we are traveling with the earth, just as the archer above did not know his arrow left the bow at an angle. Related to path momentum, scientists have shown that photons can have a small amount of mass.[24]

Thus, what my experiment demonstrated affects both ether and photons. If ether exists, my experiment proves that ether drag exists. On the other hand, if photons exist, my experiment proves that photons have path momentum.

But before anyone gets comfortable with photons having path momentum, there is another experiment that needs to be discussed in conjunction with my first experiment. But first, more preliminary train examples.

## Path Momentum and the Photon Theory

In the just mentioned train example, the arrow was aimed perpendicular to the direction of the train the archer was on. We will now discuss what path momentum does if the arrow is aimed parallel to the direction of the train.

Now let us consider another arrow example. Suppose there are two train tracks, obviously parallel to each other, going through two parallel tunnels under the same bridge or hill. Suppose the two trains are each traveling at 80 kph, but are going in ***opposite*** directions. Suppose there is an archer on each train and suppose there is a target half-way between the two tunnels, attached to the outside wall of the bridge (i.e. the target is fixed and is not moving).

Now suppose that one train is just getting out of the tunnel and the other train is about to enter the tunnel and that both flatbed cars that the archers are on are on the same side of the tunnel, the side that the target is on, but their respective trains are traveling in opposite directions.

Now suppose that at the exact instant that both archers are across from each other (meaning they are exactly the same distance from the target), they both shoot an arrow at the target with exactly the same bow energy.

Here is the question: will both arrows arrive at the target at the same instant of time and with the same velocity? The obvious answer is "no." The arrow shot from the train heading into the tunnel will have significantly greater velocity than the arrow shot from the train heading out of the tunnel.

This difference in velocity is caused by exactly the same "path momentum" as discussed above when the two trains were traveling in the same direction. The only difference is that these arrows are shot parallel to the direction of the trains - one forward and one to the rear.

In exactly the same way that path momentum applies to arrows, my experiment proves that path momentum applies to photons. If arrows or photons have perpendicular path momentum, they also have parallel path momentum.

My first experiment proves that photons have path momentum when the laser is shot perpendicular (or nearly perpendicular) to the direction the earth is headed. It would therefore be ludicrous to assume that photons do not also have path momentum when the laser or light source is pointed in a parallel direction to the path of the earth towards Leo.

In a real archer example, the velocity of the arrow is affected by the velocity of the train the archer is standing on. In other words, the motion of the train ***the archer is on*** actually causes the velocity of the arrow to increase. This is general physics. Because the arrow leaves the bow at an angle, it must travel further to the target than if both trains were standing still. Thus, even though the arrow has to travel further if both trains are in motion (think of the diagonal of a right triangle), the increased speed of the arrow caused by the motion of the train the archer is on (i.e. path momentum increases the speed of the arrow) offsets the increased distance of following the diagonal.

Because I got a dot (instead of an ellipse), it is clear that the photons traveled along the diagonal of the triangle. However, because I got a dot (instead of a smaller ellipse) there is evidence the photons increased their velocity due to the motion of the earth towards Leo. In other words, if the photons had traveled along the hypotenuse or diagonal, but did not increase their velocity due to the motion of the earth, I still would have gotten an ellipse, but it would have been much smaller than the original ellipse.

This is all very nice theory, but in fact my equipment was not accurate enough to guarantee that the velocity of the photons (assuming the photon theory) did

increase. Therefore, I must rest my case on the general physics of momentum - momentum does increase the velocity of objects.

Thus using general physics, if we shot laser beams, instead of arrows, at the target attached to the tunnel wall, and if the trains were traveling at 370 kps (and the earth were stationary in the universe), the velocity of the photons hitting the target would be the speed of light, plus or minus 95% of 370 kps (I use 95% because my most accurate experiment, which used a telescope, was only 95% accurate). This means that the speed of light would be c-v and c+v (adjusted by no less than 95% of v, where v is the velocity of the earth towards Leo). Again, all of this is discussion is assuming the photon theory. With the ether theory things are totally different.

## The First Major Paradox in This Book

There are only two ways to explain why I got a dot:
1) Ether exists and there is ether drag surrounding the earth (note that the experiment was done completely inside of our ether drag, thus the laser, the target, and the light beams would all be dragged together with the ether drag and a dot would be predicted), or
2) Photons have path momentum and the speed of photons is c-v and c+v, where v is the velocity of the earth.

But now there is a problem with the photon theory. Based on the c-v and c+v which would result from the path momentum of photons, it is absolutely clear that the Michelson-Morley Interferometer ("***MMI***") should ***not*** have received the null result. In other words, my null result proves c-v and c+v, but that is exactly what Michelson and Morley were looking for! The MMI could have detected differences in the speed of light well below 30 kps (remember back then they were assuming our total velocity in space was only 30 kps), but my experiment proves that the speed of light varies by at least plus or minus ***351 kps*** if the photon theory is true**!** In other words, the velocity of light must be 300,000 kps plus or minus 95% of 370 kps, meaning 300,000 kps plus or minus 351 kps, if the photon theory is true. The MMI, and numerous interferometers build since then, could easily have detected such a vast difference in the speed of light.

The MMI experiment (and many other interferometers), which deal with the ***speed of light*** (which are ***looking*** for c-v and c+v), and my experiments, which deal with the ***path of light*** (which ***prove*** c-v and c+v), meaning the MTLs, could not both have gotten null results if the photon theory were true. If photons have path momentum, then the MMI should not have gotten a null result. But if photons do not have path momentum, then my experiment should not have gotten a null result.

But both experiments could have gotten null results with the ether drag theory because both the speed of light and the path of light are relatively constant within the ether drag (the speed of light would only be affected by our earth's rotation speed).

There are other experiments that need to be mentioned. The Sagnac effect proves that the velocity of light on the surface of the earth is c-v and c+v, but in this case v is ***not*** the total velocity of our earth through space, but it is the ***rotation*** velocity of the earth at the latitude of the experiment. In other words, the Sagnac effect, the Michelson-Gale and Pearson experiment, discussed in Chapter 1, and the Hafele-Keating experiment, also discussed in Chapter 1, have all detected the ether wind being equal to the rotation velocity of the earth**!** This should be a clear signal that ether and ether drag exist. Now we will move on to my second experiment.

# Chapter 9

# My Second Experiment

"It is the mark of an educated mind to rest satisfied with the degree of precision which the nature of the subject admits and not to seek exactness where only an approximation is possible."
Aristotle (384 BC - 322 BC)

## Where We are Going Next

My first experiment proves, using the path of light, that the light ***from lasers*** must have path momentum. I will call this "***laser path momentum***" ("***LPM***") meaning the light coming out of a laser (or from a target to a telescope) must have path momentum and the light must exit the laser at an angle.

In this chapter and the next chapter we will look at whether the light that bounces off of mirrors also adds path momentum, which I will call "***mirror path momentum***" ("***MPM***"). My second experiment, which will be discussed in this chapter, concludes that MPM does ***not*** exist (i.e. MPM is false) in the photon theory. The next chapter will continue this discussion using the Lunar Laser Ranging experiments.

## Laser Path Momentum (LPM)

Because we are going to use a little mathematics in this chapter, let us first look at the experiment in the last chapter and redo it using actual mathematics.

Thus, let us assume:

1) The speed of light is ***exactly*** 300,000 kps.
2) The speed of the earth towards Leo is ***exactly*** 370 kps.

These are accurate enough numbers for our purposes here. Let us assume the experiment is done at 50 meters (i.e. the mirror is placed 50 meters from the laser).

Light travels 300,000,000 ***meters*** per second. Thus, it takes 50 / 300,000,000, or .0000001666... seconds for light to travel 50 meters. During this time, the earth travels .061666... meters (.0000001666... times 370,000 ***meters*** per second) or 6.1666... cm towards Leo. My equipment was easily accurate enough

to detect this value, furthermore, my ***first*** experiment was done at about 100 meters, so we could double this value.

Let us now build a triangle, with sides a, b and c.

Side a = .061666... m
Side b = 50 m

Angle A is the angle opposite Side a. While it is true that Side c is the actual path of the laser beam, it is not mathematically significant to this discussion and will be ignored.

(Note: it may seem strange that I am using approximations for the speed of light and for our velocity towards Leo and that I am ignoring the actual path of the laser beam, but that I am using 6 or more decimals of accuracy at other times. My only concern is whether my equipment is capable of detecting a calculated distance, thus there is nothing lost in using approximations mixed in with trig formulas. See the quote at the beginning of this chapter.)

Since by my first experiment, I got a "dot," then we can conclude that Angle A is the angle at which the laser beam is affected by path momentum. We will now calculate this angle:

If we had a right triangle, with one side of 50 m and another side of .061666... m, then Angle A = 0.070665 degrees. To calculate it:

Angle A = arctan (a / b)
Angle A = arctan (.061666... / 50)
Angle A = 0.070665 degrees

Angle A represents the angle at which light exits a laser beam because of path momentum.

Now that we know this angle we could calculate how far the earth moves in the time it takes light to travel 50 m. This calculation is done as follows:

side a = (b * sin A) * sin B
side a = (50 * sin 0.070665 degrees) * sin 89.929335 degrees
side a = .061666... m

Obviously, this is same number we started with because it is the number we plugged into Side a above (this was just a sanity check).

Note that the angle that was calculated was designed to "get a dot." In other words, since my first experiment always got a "dot," the angle of path momentum was calculated so that the laser beam would hit the same spot every time.

Let a "***path momentum unit***" be a part of the experiment at which an angle of 0.070665 is ***added*** to the laser beam. If a "path momentum unit" was not added at the point the laser beam leaves the laser, because of the MTLs the laser beam would have missed the center of the target and I would have gotten an ellipse. However, because of the one "path momentum unit" added by the laser, and because the earth moves one "***earth unit***" (i.e. the distance the earth moves while the laser beam is in the air - .061666... m), I got a consistent "dot." Generally, as long as the number of "path momentum units" equals the number of "earth units," a "dot" will result for all 24 hours of the experiment.

## Simplifying the Visualizations

Before going on it is necessary to simplify the visualizations (assuming the photon theory) before things get out of hand. In the prior chapter I made 25 different readings, over a 24 hour period, to obtain my results. In this chapter, because we will be dealing with a mirror, doing a simple globe experiment is not as practical. The good news is that we can reduce the number of markings that we need to study down to two.

Let us study exactly two angles that light leaves the laser. First, we will study the angle when the relationship between the laser vector and our vector towards Leo is at its closest to perpendicular. In fact, for discussion purposes we will assume it is perpendicular and that Leo is to the right of the laser (i.e. to the right to a person standing behind the laser). Second, we will study the angle 12 hours later, when the laser and target have switched places relative to our path towards Leo. I mentioned this in the prior chapter during the globe exercise. Let us do a simple experiment.

Suppose there is a long, narrow room. Now let us draw a line down the middle of the long axis of the room, which is half-way between the walls that form this long axis. In other words, this line goes down the middle of the room, along the long axis of the room.

Now let us position two people that are standing face-to-face, three meters apart. A line drawn between these two people is perpendicular to the "***line along the long axis***," meaning the line that goes down the middle of the long axis of the room. Let the center point of the line between the two people touch the "line along the long axis" (i.e. the two people are equidistance from the line along the long axis). Now let us put the two people at one end of the line along the long axis, and let us put a table or chair at the other end of the line along the long axis (i.e. at the other end of the room). Let us name these people Person L and Person T. As Person L faces Person T, the table is to Person L's right.

Person L represents the laser. Person T represents the target the laser is aimed at. The table or chair represents Leo. The line along the long axis represents our path towards Leo. If Person L gently throws a ball to Person T, this will represent firing a laser beam at the target.

Now let us do an experiment. Let Person L gently throw a ball such that it is aimed 1 meter to the ***right*** of Person T (from Person L's perspective). Note that this angle is in the direction of Leo, meaning it lands between Person T's original position and Leo. In the time it takes the ball to get to Person T, let Person T moves 1 meter to Person' T's left (1 meter equals 1 earth unit in this crude case) or 1 meter to Person L's right. Note that the ball hits the center of Person T. The angle at which Person L throws the ball represents the path momentum of laser light as it leaves the laser. From the perspective of Person L, the ball (i.e. the laser beam) leaves at an angle to his ***right***, which is towards Leo and in this example this angle represents one path momentum unit. Thus, the ball is thrown at one path momentum unit and Person T moves one earth unit, and the ball hits Person T. This represents the first measurement in my first experiment discussed in the prior chapter.

Now let Person L and Person T switch places. This will represent the positions of the laser and target 12 hours later, meaning after 12 hours of the earth's rotation. Now Person L will have to throw the ball to his ***left*** (the angle is always towards Leo), because the path momentum is now going to carry the laser beam to the left of the laser (from the perspective of the laser or Person L), in the general direction of Leo.

If the reader is having problems understanding why the two people need to switch places, go back to the globe exercise and note that the laser (one end of the toothpick) and the target (the other end of the toothpick) have switched placed after the globe has been rotated for 12 hypothetical hours. Because of path momentum the laser beam will ***always*** angle away from the laser ***in the direction of Leo***, thus at the beginning the laser will angle away from the laser to the ***right*** (towards Leo), and 12 hours later the laser will angle away to the ***left*** (towards Leo) (assuming Leo started out to the right of the laser).

In this second case, Person T moves one earth unit to her right or one earth unit to the ***left*** of Person L. Because the laser beam always angles towards Leo, the path momentum of the laser beam angles to the left, and the ball again hits person T. This represents my first experiment at the 12 hour mark.

We have seen in two instances that Person T received the ball, in the original or first throw and a throw 12 hours later. We can therefore assume that if we had done the complete 25 throws that we would have consistently hit Person T. Thus, we can reduce the number of throws (i.e. measurement points) from 25 down to 2.

This simple exercise replicates the first experiment discussed in the prior chapter.

## One Mirror

Let us suppose that we have a laser pointed at a mirror 50 m away. Let us suppose that the ***actual aim*** of the laser beam is exactly normal or perpendicular to the mirror. Let us fire the laser at the mirror. Because of path momentum, the angle at which the laser beam hits the mirror will be exactly 89.929335 degrees (i.e. 90 minus 0.070665). Thus, because this is a mirror, the light will exactly exit the mirror at the same angle. In essence, the mirror creates a "***reflected***" path momentum unit because it ***reflects*** the light at the same angle that it receives this light. But this second path momentum unit is not because the mirror ***adds*** one path momentum unit, it is because it ***reflects*** one path momentum unit that it received from somewhere else (i.e. it receives this path momentum unit from the laser and simply ***duplicates*** it or reflects it).

Let me summarize this as follows. If a mirror ***reflects*** one path momentum unit, and does ***not add*** one path momentum unit, then when the light gets back to the laser, there are two path momentum units, one from the laser and one is a duplicate of the laser's path momentum unit. During the time the laser was "in the air," the earth moves two "earth units" (one when the light traveled to the mirror, and one when it traveled back from the mirror to the laser), thus the two path momentum units offset the two earth units and the beam is predicted to hit the center of the target (i.e. a "dot" will result). The same result would occur twelve hours later, even though the laser and mirror have switched places.

## One Mirror - Simplified

Let us return to our two-person example above. Suppose Person T holds a hypothetical mirror.

T0) Time 0: Person L releases the ball. Both Person L and Person T are at "origin," and are across from each other.

T1) Time 1: Person L and Person T move 1 earth unit from origin between T0 and T1 and are both standing on "***position earth unit 1***" (i.e. 1 earth unit from origin), across from each other. The ball hits the mirror and the mirror angles the ball at the same angle that Person L threw it. The mirror aims the ball towards position earth unit 2.

T2) Time 2: Person L and Person T move another earth unit between T1 and T2 (making a total of 2 earth units that both of them have moved). Both Person L and Person T are standing on position earth unit 2 when the ball arrives back to

Person L's side. The ball lands where Person L is located because the mirror reflected the path momentum unit that Person L originally used.

Twelve hours later, the reverse would happen and the ball would again hit Person L at T2 only in this case everything moves to the left. Thus, we predict a dot for the entire experiment.

(Note: In this case the target is the laser itself, thus it would be necessary to have the mirror tilted slightly up (but not side-to-side) so that the beam would hit directly above the laser.)

Now let's do this same example with the mirror ***adding*** one path momentum unit.

## One Mirror - Adding One Path Momentum Unit

T0) Person L releases the ball. Both Person L and Person T are at "origin," and are across from each other.

T1) Person L and Person T move 1 earth unit from origin between T0 and T1 and are both standing on "position earth unit 1," across from each other. The ball hits the mirror and the mirror angles the ball at the same angle that Person L threw it plus the mirror adds one path momentum unit. This means that at T1, the mirror is aiming the ball at "position earth unit 3."

T2) Person L and Person T move another earth unit between T1 and T2 (making a total of 2 earth units that both of them have moved). Both Person L and Person T are standing on position earth unit 2 when the ball arrives back to Person L's side. The ball lands at position earth unit 3. Thus, the ball lands one earth unit to the ***right*** of where Person L is standing when the ball arrives.

Now let us do this experiment twelve hours later.

T0) Person L throws the ball. Both Person L and Person T are at "origin," and are across from each other.

T1) Person L and Person T move 1 earth unit from origin between T0 and T1 and are both standing on position earth unit 1, across from each other. It should be noted that because Person L and Person T have switched positions, that from the perspective of Person L, position earth unit 1 is 1 earth unit to the ***left*** of Person L. In other words, everything is moving to the ***left*** from the viewpoint of Person L and thus ***left*** is the natural direction of the earth units in this case. The mirror angles the ball one earth unit to the left (from Person L's perspective) because it is reflecting the path momentum of Person L, ***plus*** it angles the ball one additional earth unit to the left because it is adding a path momentum unit. At T1, the mirror is therefore aiming the ball at position earth unit 3.

T2) Person L and Person T move another earth unit between T1 and T2 (making a total of two earth units that both of them have moved). Both Person L and Person T are standing on position earth unit 2 when the ball arrives back to Person L's side. The ball lands at position earth unit 3, which is one earth unit to the ***left*** of Person L.

In the original case the ball landed one earth unit to the ***right*** of Person L, and 12 hours later the ball landed one earth unit to the ***left*** of Person L. Should we expect a pattern or a dot? Think about it for a moment before reading on.

The essence of expecting a pattern is that the ball lands in exactly the same spot, ***relative to Person L's location when the ball lands***, for the entire 24 hours, on in this case, in both instances. Relative to Person L, in the first experiment the ball lands to his ***right***. In the second experiment the ball lands to his ***left***. Therefore, we conclude that the ball does ***not*** land in the same spot for both experiments (relative to Person L), thus we conclude we would get some kind of pattern. In doing these experiments we must know where the ball lands relative to Person L. This spot must be the same for both experiments. Obviously, in this case it is not.

It will become critical later in the chapter to remember that we must keep track of both the laser beam and the location of Person L. It is where the laser beam lands, relative to where Person L is located, that determines whether we get a dot or a pattern of some kind. We don't really care at this point what the pattern looks like, we are only concerned that we do not get a dot.

## A Potential Problem

Let us return to the example where the mirror did ***not*** add a path momentum unit, it simply reflected a path momentum unit. We predicted a dot. However, there is a potential problem with the above analysis. What if our equipment was not set up correctly, and the ***aimed*** laser beam was not exactly normal to the mirror? To be more specific, what if the normal vector of the mirror was not equal to the ***aimed*** laser beam, but rather it was equal to the ***actual*** laser beam, meaning the laser beam ***after*** laser path momentum? In this case, if the mirror would ***not reflect*** a path momentum unit, the mirror would reflect a 90 degree angle. In this case there would be two earth units, but only one path momentum unit (from the laser). The beam would not hit where the laser is when the beam returns.

However, what if the mirror ***added*** one path momentum unit in this case? If it did, the laser would add one path momentum unit, the laser beam would arrive at a 90 degree angle, and the mirror would ***add*** one path momentum (this is ***not*** a reflected path momentum unit, this is an ***added*** path momentum unit). Thus, there would be two path momentum units and two earth units, and the laser

beam would hit the target. Twelve hours later, because the laser's path momentum unit and the mirror's path momentum unit are both in the same direction (towards Leo), reversing the position of the laser and target would not change anything, the dot would still be hit 12 hours later.

Thus, we have a situation where if the mirror did not add a path momentum unit, a dot results (the case where the mirror is normal to the ***aimed*** laser beam), and we have a situation where if the mirror did add a path momentum unit, a dot results (the case where the mirror is normal to the ***actual*** laser beam after the path momentum unit angle is added). Thus, unless we had equipment accurate enough to guarantee the aimed laser beam was normal to the mirror, this experiment would tell us nothing about mirror path momentum, even if we got a dot.

Because the motion of our earth adds such a small angle to the laser beam, my equipment was not accurate enough to guarantee that the ***aimed*** laser beam was normal to the mirror (it is more complicated to do than it looks because you ***obviously*** cannot use surveyor equipment). Thus, I had to abandon this type of experiment in looking for mirror path momentum.

## Tilting the Mirror To One Side - No Added MPM

The only way to resolve the problem of using a mirror that happened to be normal to the actual laser beam was to tilt the mirror to one side to guarantee that the mirror could not possibly be normal to the actual laser beam by accident. In other words, the mirror in my second experiment was tilted so that the returning laser beam hit about two meters to the ***right*** of the laser position (looking from behind the laser). This guarantees that the ***actual*** laser beam does not accidentally hit normal to the mirror.

Let us first calculate how much we need to tilt the mirror, to one side, in order for the returning beam to hit 2 meters to the right of the laser. It should be emphasized that the line/vector between the laser and mirror is normal to the wall behind the laser, meaning the entire affect of the tilt is ***after*** the laser beam hits the mirror. In calculating this we will need to ignore all types of path momentum for the moment.

Side a = 2 m
Side b = 50 m

Angle A = atan (a / b)
Angle A = atan (2 / 50)
Angle A = 2.290610 degrees

This angle assumes there is no path momentum of the laser beam. Since there must be LPM, we must add .070665 to the above angle to determine at what angle the light is actually hitting the mirror.

2.290610 + .070665 = 2.361275

Now we must calculate how far the reflected laser beam will miss the laser (assuming there is no ***added*** path momentum by the mirror):

Side a = b * tan A
Side a = 50 * tan 2.361275 degrees
Side a = 2.061768 m

This number is almost exactly equal to the 2 meter intentional miss plus the typical .061666... m miss caused by laser path momentum. The difference is unmeasurable (using my equipment).

At this point we must calculate exactly where the laser is when the beam hits the wall, and exactly where the beam hits the wall.

T0) Laser is at origin.
T1) Laser is .061666... m from origin (towards Leo)
T2) Laser moves another .061666... m, making a total of .123333... m

T0) Beam is at origin
T1) Beam is at .061666... m from origin (towards Leo) when it hits the mirror
T2) Beam moves another 2.061768 m (see above), making a total of 2.123435 m

The difference between where the Laser is and the Beam is is 2.000102 m. Of course it is to the ***right*** of the laser. This result is not surprising.

## Tilting the Mirror To One Side - No Added MPM - 12 hrs. later

Now we must go through the same exercise 12 hours later, when the laser and the target/mirror have switched places. This time we need to subtract the laser path momentum from the mirror tilt. The reason is that the mirror is still tilted to the right (the mirror never moves), but the path momentum is now to the left (i.e. towards Leo) after switching places.

2.290610 - .070665 = 2.219945

Now we must calculate how far the reflected laser beam will miss the laser (assuming there is no ***added*** path momentum by the mirror):

Side a = b * tan A
Side a = 50 * tan 2.219945 degrees
Side a = 1.938238 m

This number is almost exactly equal to the 2 meter intentional miss ***minus*** the typical .061666... m miss caused by laser path momentum. The difference is unmeasurable.

At this point we must calculate exactly where the laser is when the beam hits the wall, and exactly where the beam hits the wall.

T0) Laser is at origin.
T1) Laser is -.061666... m from origin (left of laser origin)
T2) Laser moves another -.061666... m, making a total of -.123333... m to the left of the laser origin.

T0) Beam is at origin
T1) Beam is at -.061666... m from origin (left of beam/laser origin)
T2) Beam moves another 1.938238 m (see above), making a total of 1.876571 m to the ***right*** of the laser origin. This is predominantly because the mirror is tilted to send the light to the right of the laser (from the perspective of the laser).

The ***difference*** between where the Laser is and where the Beam is is 1.999904 m. As above, it is to the ***right*** of the laser.

The difference between 2.000102 and 1.999904 (12 hours later) is unmeasurable. Thus we conclude that we would get a dot if the mirror is tilted and the mirror does ***not*** add path momentum. The reader should pay close attention to the fact that it is where the beam hits the wall, ***relative to where the target is*** (i.e. the wall behind the laser is the target in this case), that determines whether a dot is received. Keeping track of where the target is is just as important as keeping track of where the laser beam is.

## Tilting the Mirror To One Side - Added MPM

The tilt of the mirror in this case is exactly the same (the mirror is not touched during the experiment, nor is the laser). But in this case we must add one path momentum for the ***reflected*** laser path momentum ***plus*** we must add a second path momentum for the assumed (in this case) ***added*** path momentum by the mirror.

The reader should remember that before we tilted the mirror, assuming no MPM was added, we got a dot. We also got a dot if we did tilt the mirror, assuming no MPM was added. On the other hand, we did ***not*** get a dot if we assumed MPM was added. We will come to the same conclusion if we tilt the mirror.

Let us add the two path momentum units (one reflected from the laser and one added) to the tilt:

2.290610 + .070665 + .070665 = 2.431940

Now we must calculate how far the reflected laser beam will miss the laser (assuming there ***is added*** path momentum by the mirror):

Side a = b * tan A
Side a = 50 * tan 2.431940 degrees
Side a = 2.123543 m

This number is almost exactly equal to the 2 meter intentional miss plus ***double*** the typical .061666... m miss caused by laser path momentum. This is what we expected because the mirror is now adding path momentum in this case.

At this point we must calculate exactly where the laser is when the beam hits the wall, and exactly where the beam hits the wall.

T0) Laser is at origin.
T1) Laser is .061666... m from origin (towards Leo)
T2) Laser moves another .061666... m, making a total of .123333... m

T0) Beam is at origin
T1) Beam is at .061666... m from origin (towards Leo)
T2) Beam moves another 2.123543 m (see above), making a total of 2.185210 m

The difference between where the Laser is and the Beam is is 2.061876 m. This does not surprise us since we added one path momentum unit for the mirror.

## Tilting the Mirror To One Side - Added MPM - 12 hrs. later

Now we must go through the same exercise 12 hours later, when the laser and the target/mirror have switched places. This time we need to subtract the ***laser*** path momentum from the mirror tilt (because it is reflected) and we must subtract the ***mirror*** path momentum from the mirror tilt. The reason is that the mirror is still tilted to the right, but the reflected laser path momentum is now to the left (i.e. towards Leo after switching places) and the mirror path momentum is in the same direction as the laser path momentum - to the left.

2.290610 - .070665 - .070665 = 2.149281

Now we must calculate how far the reflected laser beam will miss the laser (assuming there is ***added*** path momentum by the mirror):

Side a = b * tan A
Side a = 50 * tan 2.149281 degrees
Side a = 1.876481 m

This number is almost exactly equal to the 2 meter intentional miss ***minus*** the typical .061666... m miss caused by laser path momentum ***minus*** the path momentum added by the mirror.

At this point we must calculate exactly where the laser is when the beam hits the wall, and exactly where the beam hits the wall.

T0) Laser is at origin.
T1) Laser is -.061666... m from origin (left of laser origin)
T2) Laser moves another -.061666... m, making a total of -.123333... m to the left of the laser origin.

T0) Beam is at origin
T1) Beam is at -.061666... m from origin (left of beam/laser origin)
T2) Beam moves another 1.876481 m (see above), making a total of 1.814815 m to the ***right*** of the laser origin. This is predominantly because the mirror is tilted to send the light to the right of the laser (from the perspective of the laser).

The difference between where the Laser is and the Beam is is 1.938148 m.

The difference between 2.061876 (origin) and 1.938148 (12 hours later) is .123728 m which is equal to 12.3728 centimeters. This is a measurable amount with my equipment. Thus we conclude that we would ***not*** get a dot if the mirror adds path momentum. This is consistent with the result before we tilted the mirror.

## The Actual Experiment

In the actual experiment, my laser died at the 14 hour mark, but the second 12 hours of the experiment would have been a mirror image of the first 12 hours (i.e. it would have been the other half of any pattern), thus the experiment lasted long enough to make a determination. I got a dot for 14 hours, thus I can safely conclude I would have gotten a dot for 24 hours, if my laser had lasted that long. This means that this second experiment proves that MPM is ***false***, meaning a mirror does ***not*** add path momentum in the photon theory. The significance of this will become evident in the next chapter.

# Chapter 10

# Lunar Laser Ranging Experiments

"It is easier to find a score of men wise enough to discover the truth than to find one intrepid enough, in the face of opposition, to stand up for it."
A. A. Hodge

## The Tilt of Aberration for the Interior Planets

One of the things I really wanted to know was the “tilt of aberration" for light from the interior planets. It didn’t take long to realize that this determination is impossible because no one really knows the ***actual*** or exact location of any planet. We only know their ***apparent*** positions, meaning we only know the direction they ***appear*** to be as we look at them. It is somewhat of a paradox. If we knew where they were, we would know the tilt of aberration. Or if we knew the tilt of aberration, we would know where they are. But we don't know either.

Celestial mechanics formulas only predict the ***apparent*** positions of planets and are unconcerned with their actual locations. Because spacecraft make numerous course adjustments during flight, not even NASA or the JPL knows the exact position of any of the planets. In fact, no one even knows the exact location of the moon because no one knows the tilt of aberration of lunar light, even though humans have walked on its surface.

(Note: Actually, it was known prior to the Lunar Laser Ranging experiments that aberration of moonlight was zero, thus they knew the moon was where it appears to be, but this was not common knowledge. I will not assume a prior knowledge of that fact, I will calculate it anew.)

Fortunately, Lunar Laser Ranging experiments, which have been done since 1969, and continue to be done today, provide key information about light and the moon. Its value, in the context of this book, is that we know exactly where the light from specially designed mirrors on the moon is being ***aimed***.

# Introduction to Lunar Laser Ranging

The experiments that that will now be discussed are called: Lunar Laser Ranging ("***LLR***") experiments and are currently being done at facilities such as the McDonald Laser Ranging Station facility in Texas ("***MLRS***").[25] These experiments consist of powerful laser beams being bounced off of special types

of mirrors, called "***retro-reflectors***", that have been placed on the moon (retro-reflectors will be discussed in a moment).

The reason such experiments are important to this book is that we know ***exactly*** where these mirrors are located on the moon, and just as importantly, we know exactly where the returning light is "aimed" by the reflected laser beams**!**

In 1969, the Apollo 11 astronauts placed a small box on the moon's surface. This device was a very special type of mirror: a retro-reflector. Because it was placed on the moon it is frequently called a "***lunar retro-reflector***." What is special about a retro-reflector is that it reflects light back to its point of origin.[26.27.28]

To understand this, note that a normal mirror will reflect a 15-degree light ray away from the point of origin, meaning the light will exit the mirror at 15-degrees away from the point of origin. But a retro-reflector, which actually consists of an array or grid of "corner cubes" or "corner reflectors" of mirrors, returns light back to the point of origin. The Apollo 11 retro-reflector contained 100 "corner cubes." To make sure there is no misunderstanding as to what a retro-reflector does, suppose you are standing 15 degrees from a vector that is normal to the surface of a retro-reflector. If you fired a laser at the retro-reflector, the beam would come back and hit you**!** A retro-reflector does not reflect light at an angle, as a normal mirror does, a retro-reflector is specially designed to send light back to where it came from. That is why we know exactly where a retro-reflector is aiming its reflected light.

In total, there were 5 retro-reflectors placed on the moon between 1969 and 1973, but only 4 of them are functional. The largest of these retro-reflectors, and the one most often used in LLR experiments, was left by the Apollo 15 astronauts in 1971. Retro-reflectors are generally about the size of a small suitcase.

The major purpose of LLR experiments is to determine various facts about the relationship between the moon and the earth and to learn specific facts about the earth. For example, measuring the time it takes the laser pulse to make the round trip between the earth and moon, at different times of the day, can yield very accurate measurements of the distance between the moon and earth. This assumes the speed of light is a constant during the trip, which is an assumption that will be discussed much later in this book.

In a LLR experiment, a very short pulse of laser light is fired through a telescope at one of the retro-reflectors. The reason the laser is fired through a telescope is to "***collimate***" the laser pulse, which will now be explained. When light normally leaves a laser the angle at which the light leaves the laser is frequently very high, perhaps as high as 30 degrees or more, depending on the laser. This angle is called "***beam divergence***"

Think of a flashlight. If the angle of light from the flashlight (the angle formed by the two sides or edges of the outside of the main beam) was zero degrees (meaning the edges were parallel), then 100 yards away the width of the flashlight beam would be the width of the flashlight lens. But that is not the case, the light from flashlights, and some types of lasers, is very broad, meaning at 100 yards away the beam might be 30 yards wide or more. When the angle of light that leaves a laser is too high, lenses or mirrors can be used to make the beam divergence angle smaller. When that happens the size of the beam is wider, but the beam divergence is smaller. That is the trade-off, you can have a narrow beam coming out with high beam divergence or you can use a collimator and have a wide beam coming out, but with small beam divergence.

With lasers that are shot at the moon, it is very important that the minimum beam divergence possible be achieved. This is because only a very, very small percentage of this laser light actually hits the small retro-reflector and is returned to the earth. Telescopes are used to collimate these laser beams so that the smallest possible beam of light (and thus the most intense beam of light on the moon's surface) hits the moon. Even though telescopes make the beam very wide at the time the beam is shot, the collimation more than makes up for this wide beam when the beam hits the moon.

Shooting through a telescope also provides another benefit. Telescopes have tracking mechanisms that are very, very accurate. Thus by shooting a laser through a telescope, the pointing of the laser is very accurate. When the beam gets to the moon it is about 7 km in diameter and when it returns from the moon it is about 20 km in diameter.[28] Only a very, very small percentage of the 7 km diameter laser beam actually hits the retro-reflector, thus only a minuscule amount of light actually returns to the earth. Furthermore, only a minuscule amount of the 20 km wide returning light actually hits the sending telescope. Needless to say, extremely sensitive detection equipment is needed to detect the returning light.

The returning lightwaves are measured by a detection device such as a photo-multiplier or photo-diode, which is coupled to the same telescope that fired the laser. A telescope is used to capture the returning light because it has a large diameter to gather in more light than other devices. Nevertheless, considering the ratio of the surface area of a telescope, compared to the 20 km diameter of the returning beam, it is clear than an unbelievably small percentage of the light that is sent is actually detected after returning from the moon.

In an LLR, there are three key things to understand:
1) The optical viewing of the moon through the telescope (which is subject to the full 370 kps secular aberration of starlight that all light from all other objects in the sky is subject to - assuming the photon theory),
2) The shooting of the laser through the same telescope that is optically viewing the moon,

3) The receiving of the laser light after hitting the retro-reflector, by the same telescope.

In other words, the ***same telescope*** does the optical viewing, the firing of the laser and the receiving of any light that returns from the moon.

To better understand the significance of LLR experiments, consider this metaphor:

## Two Parallel Car Metaphor

Think about two automobiles driving nose-to-nose, 30 feet apart, at the same high velocity down a highway. Assuming a vacuum, suppose a ball is thrown from one car to the other. At the instant the ball is ***released*** from the first car by one person, a second person in the first car paints a small mark on the pavement underneath the car. In other words, one person releases the ball and a second person in the same car ***simultaneously*** paints a small mark on the pavement. Suppose that in the time the ball moves from the first car to the second car, both cars travel 100 feet. Thus, when the ball is received in the second car, both cars are about 100 feet from the mark on the pavement.

As soon as the ball arrives at the second car, someone (who is in the second car) catches the ball and immediately throws the ball so that it lands ***on the mark on the pavement*** that was painted by the second person in the first car. In other words, the ball is thrown to where the first car was when the ball was originally released from the first car. By the time the ball returns to the mark on the pavement, suppose both cars have moved an additional 100 feet away from this mark (this is obviously not accurate, but this is a metaphor). This means that when the returning ball hits the mark on the pavement, both cars will be about 200 from the ball.

Note that when the ball lands on the pavement, both cars, and we are most interested in the first car, are 200 feet from where the ball lands. This means that no one in the first car is going to catch the ball when it lands after being thrown by someone in the second car.

## Introduction to the Problems Introduced by Lunar Laser Ranging

Let us consider an infinitely long imaginary line that passes through the sun and the point in Leo that the sun is currently headed for. We will define the direction from the sun towards Leo as "north." We will draw a second line perpendicular to this line that also passes through the center of the sun. We will further draw this imaginary line on the “ecliptic” plane, which is the two dimensional plane formed by the sun and our orbit plane around the sun. Actually, we could draw this

second imaginary line on the earth-moon 2D plane, which is very close to being on the ecliptic plane.

We have timed drawing this second line so that it goes through both the center of the earth and the center of the moon (or as close as possible because the two planes are not the same). In other words, we waited until the earth and moon were in the correct positions before we drew this line. The portion of this line to the left of the line to Leo (from our viewpoint from above the north pole with our head pointed towards Leo) will be defined as “west” and the portion of a similar line on the other side of the sun, to the right of the sun, will be defined as “east.”

This scenario means that the earth and moon are “nose-to-nose” as they are both headed towards Leo. (Note: we can ignore the orbit velocity of the moon around the earth and the rotation velocity of the moon because they are so slow).

With this scenario, let us visualize what happens when a LLR experiment is done. First, a laser beam is shot at the moon and retro-reflector. During the time it takes this laser beam to travel to the moon ***and back*** (about 2.5 seconds), both the earth and moon (as part of the solar system) move about 948 km towards Leo (474 km while the beam is headed to the moon and 474 km while the beam is headed back to earth). ***Since the retro-reflector sends light back to its point of origin***, and because the returning beam is only 20 km wide when it returns, then the returning laser beam should miss the telescope (that shot the laser beam) by at least 928 km (948 km minus 20 km). This is because both the earth and moon have moved 948 km towards Leo while the laser beam was "in the air." But in fact the laser beam is detected by the ***same telescope*** that shot the laser in the first place**!**

With this scenario, the LLR is a type of experiment virtually identical to the “Two Parallel Car Metaphor.” The line between the sun and Leo is represented by the path of the two parallel cars. The person in the first car that throws the ball is represented by the telescope that shoots the laser beam. The person in the second car, who throws the ball back to the spot on the pavement, represents a retro-reflector that returns light back to where it came from, meaning to where the telescope was when the laser was originally fired. The returning laser beam should miss the originating telescope by at least 928 km. I will come back to this example later in much more detail. For now, I want to present a "big picture" of what is going on.

## More About the LLR Experiments

The actual process of doing an LLR experiment begins with an observer "***finding***" the retro-reflector on the moon. By "finding" the retro-reflector it is meant that they can detect returning light from the moon after firing the laser and

the detected light is not "noise." I cannot talk about all of their challenges, but I will mention three of the problems they face:
1) The most significant problem is "image motion," caused by hot and cold cells in the earth's atmosphere. The hot and cold cells cause the image to weave back and forth and up and down.
2) Secondly, "seeing" problems are encountered when a point of light on the moon, or from a star, is "blown-up" or enlarged by either temperature cells or particles in the atmosphere.
3) Third, "dither" problems are jerks in the image caused by the finite mechanical equipment in the telescope drive system.

An observer begins by pointing the telescope, as accurately as possible, to where the retro-reflector is located on the moon. I call this initial pointing of the telescope, whether successful or not, "***ground zero***."

Obviously, no telescope on earth can see an object the size of a suitcase on the moon (not yet anyway), but when the sunlight is hitting the section of the moon where the retro-reflector is located, the observer can see various lunar features in the landscape near the retro-reflector they are going to aim at, thus allowing accurate pointing.

When the retro-reflector is in the shadowed part of the moon, the observer must first calibrate the telescope and computer for several well-known reference craters on the moon that are in the sun's light. But even that is not easy because the shadows cast by the cliffs that are on the sides of the craters vary in length depending on the angle of the sun to the cliffs. Once these reference craters are used to calibrate the computer, the computer moves the telescope to where it thinks the chosen retro-reflector is in the dark section of the moon.

When ground zero is first attempted, either by the observer or the computer, the observer may not have "found" the retro-reflector on the first shot and he or she may need to start "clicking" the telescope controls to "find" the retro-reflector. Frequently, however, it is not necessary for the observer to "click" the controls because the laser light is returned and is detected in the first laser firing.

When "clicking" is necessary, each "click" makes a 1/10 of one arcsecond adjustment (an "arcsecond" is 1/3,600 of a degree, thus a "click" is 1/36,000 of a degree) in where the telescope is pointed. It is frequently a process of "hunt-and-wait-and-peck" trying to find the retro-reflector.

## Hitting the Retro-Reflector and Looking at "Old Light"

Now let's get down to the details. When a telescope is looking at a galaxy 100,000,000 light years away, it is looking at light that left the galaxy 100,000,000 years ago. It is also looking at ***where that galaxy was located*** in the sky

(ignoring aberration, etc.) 100,000,000 years ago. The same holds true when a telescope is pointed at the moon.

When an optical telescope is pointed at the moon, because it takes 1.25 seconds for moonlight to get to the earth, the telescope is really looking at where the moon was located approximately 1.25 seconds earlier. This means that the telescope is pointed or looking at a spot that is 474 km (i.e. about 1.25 seconds times the average 370 kps motion towards Leo) ***behind*** where the moon is actually located when the light arrives at the telescope. This is based on the assumption that the earth and moon are headed nose-to-nose towards Leo at 370 kps. In other words, the light the optical telescope is seeing is "old light," meaning that by the time the lunar light arrives at the telescope, the moon has traveled 474 km, meaning the telescope is constantly looking 474 km behind where the moon is when the light arrives.

It gets worse, because in the time it takes the laser beam to get to the moon, the moon has moved an additional 474 km. This means that the laser beam, which is only 7 km wide when it gets to the moon, will miss the retro-reflector by 948 km. To explain, the telescope (i.e. the laser) is pointed (i.e. aimed) 474 km behind where the retro-reflector is located (because of "old" light) when it fires the laser. Further, it takes 1.25 seconds for the laser beam to get to the moon. If this were the case, the observers would never be able to "find" the retro-reflector (this will be discussed in a moment).

Now let us consider what would happen if there was a tilt of aberration of the laser/telescope based on 370 kps. If this were the case, at the instant the laser was fired, the telescope would be pointed directly at where the retro-reflector is located on the moon at the instant the laser is fired. This is because of two offsetting errors. The first error is that the light the telescope sees is 1.25 seconds old, meaning the laser is pointed ***behind*** where the retro-reflector is located by 474 km. However, there is a second error in which the "apparent" location of the retro-reflector would be 474 km ***ahead*** of its "old" location. Thus, because the light is 1.25 seconds old, the telescope will point behind the retro-reflector, but because of aberration, it will point ahead of the retro-reflector, meaning there is a net result that at the moment the laser is fired, the telescope is coincidentally pointed exactly at the retro-reflector.

However, this does not solve the problem. By the time the laser beam gets to the moon, the moon has moved 474 km, thus the 7 km wide beam will miss the retro-reflector by 474 km. Again, if this were the case the observers would never be able to "find" the retro-reflector. This I will now explain in detail.

1) Let T0 be the moment light leaves the moon. T1, which is 1.25 seconds later, is when the light gets to the earth from the moon, during which time the earth and moon have moved 474 km towards Leo. T2, which is 1.25 seconds later than

T1, is when the laser beam gets to the moon, and between T1 and T2 the earth and moon travel another 474 km towards Leo.
2) Because of "old light," the telescope is actually looking at where the moon was located 1.25 seconds earlier. However, with tilt of aberration of 370 kps, if the photon theory were correct, the telescope would be tilted so it would point 474 km ahead. Thus, these two things accidentally offset each other and at T1 the laser is pointed exactly where the moon is located at T1. However, in the time the laser beam is traveling to the moon, the earth and moon move another 474 km and the laser beam will miss the retro-reflector by 474 km.
3) A "click" (i.e. 1/36,000th of a degree) moves the image in the telescope 186.4 meters (remember that the light pulse is about 7 km wide by the time it gets to the moon). Note: the simplest way to calculate this is to know that the moon has an angular diameter of 0.5181 degrees (which is 18,652 "clicks") and the diameter of the moon is 3,476 kilometers.
4) The average distance to the moon is 384,400 kilometers.

With these statistics in mind, and knowing that the software that drives the computer can also be used for purely optical viewing, the ground-zero shot of an observer would miss the retro-reflector by 2,543 clicks (474,000 divided by 186.4) to the left or right of ground zero (this is the maximum number of clicks needed if the moon happened to be directly "east" or "west" of our path towards Leo).

At an average of 1 click every three seconds, it would take an observer up to 127 ***hours*** to find the retro-reflector. This assumes he or she is perfectly efficient at knowing which direction to click. As mentioned above, observers frequently "find" the retro-reflector without a single click**!** Most of the time they find the retro-reflector within 5 minutes. If they don't find it within 10 minutes, they may take a "coffee break" and then start over.

Thus, there is simply no possible way that the laser/telescope could ever hit the retro-reflector with or without secular aberration of moonlight.

A person might think that if moonlight had path momentum, that the problem would be solved. Actually, if moonlight had path momentum, the problem would get worse because the laser/telescope would point even further behind the location of the moon at the time the laser is fired. We would be back to the 948 km miss, even with aberration.

How about path momentum of the laser beam? My experiment proves that lasers must have path momentum, meaning the light leaves the laser at an angle. If the laser beam had path momentum, is there a scenario in which the laser beam could hit the retro-reflector? Actually, yes. If there ***was*** laser path momentum of the laser, and there ***was*** aberration of moonlight (i.e. tilt of aberration), and if moonlight did ***not*** have path momentum (moonlight is reflected light from the sun, just like retro-reflectors reflects laser beams), then the

observer could "find" the retro-reflector in short order, perhaps on the first try. In summary, because moonlight is "old light" when it gets to the telescope, there is only ***one*** combination of events that could explain why observers ever "see" the retro-reflector:

1) Path momentum of laser beam light (LPM is true).
2) Aberration of moonlight (tilt of aberration)
3) ***NO*** path momentum of reflected sunlight (MPM is false).

Without any of these items, and with the photon theory of light, the observer could never "find" the retro-reflector because of the "old" light issue. I will get back to this issue later in the chapter.

## The Returning Laser Beam

So far we have only talked about the observer finding the retro-reflector. Let us for a moment ignore the problems with actually hitting the retro-reflector. Let us talk about the returning laser beam hitting the telescope. We are absolutely certain where the returning laser beam is aimed, it will return the laser beam in the exactly opposite direction it came in at. That is what a retro-reflector is designed to do. We don't need to worry about hitting the retro-reflector, we are now assuming the retro-reflector is being hit and our concern is where the retro-reflector is sending its light.

If the mirrors in the retro-reflector did not add path momentum to the laser beam, the returning beam would miss the telescope by 948 km per the 2-car example. The simplest way to comprehend this is to think of the retro-reflector as being the ***origin*** of the light beam. In other words, we don't care about the process of getting the light to the retro-reflector, we are only concerned here with what the retro-reflector does with the light. We know exactly where the reflected light from the retro-reflector is aimed. It is aimed at the exact location of where the light source came from (where the telescope was when the beam was fired), without regard to any aberration of earthlight (the retro-reflector is not looking at the earth through a telescope so "aberration of earthlight" is irrelevant), path momentum of laser light, etc. Consider this scenario:

T1) (the same T1 as above) The laser beam is fired. This instant in time identifies where the laser/telescope is in 3D CMBR space at the instant the laser is fired. This is the exact location in 3D CMBR space that the retro-reflector will send the returning laser beam.
T2) (1.25 seconds after T1) The laser beam arrives at the moon and is instantly "fired" back by the retro-reflector. Between T1 and T2, as above, the earth and moon have both moved an additional 474 km towards Leo. Thus, when the retro-reflector "fires" the laser back to the point in 3D CMBR space where the laser/telescope was at T1 (T2 is the ***origin*** of the retro-reflector light), it is ***aiming***

the light 474 km behind where the telescope is located at T2. In other words, T2 is the time the retro-reflector "fires" the returning beam, but at T2 the telescope is already 474 km away from where the retro-reflector is aiming.
T3) (1.25 seconds after T2) The laser beam returns to earth. Between T2 and T3 the earth and moon travel an additional 474 km. Thus the returning beam will miss the telescope by a total of 948 km because the retro-reflector is aiming the beam at where the telescope was at T1 (I am ignoring the width of the returning beam because it is insignificant).

Because of the fact that the retro-reflector is aiming at where the telescope/laser was at T1, it is clear that the photon theory of light cannot be true.

However, now let us look at this scenario. Suppose the laser light hits exactly two mirrors in each corner cube, and that each of the corner cube mirrors adds one path momentum unit to the light. In this case the retro-reflector would add two units of path momentum to the laser beam, and the same telescope that fired the laser beam would also be able to receive the laser beam.

In other words, because of the Two Parallel Car Metaphor, the light from the retro-reflector to the earth would never hit the sending telescope unless exactly two mirrors in each corner cube added one path momentum unit each (this assumes exactly two mirrors in each corner cube are hit).

## Four More Paradoxes

Let us summarize what we have learned, ***if we assume the photon theory is true***:

**The Observer Trying to Find the Retro-reflector:**
1) Path momentum of laser beam light. LPM is true.
2) Aberration of moonlight (tilt of aberration) is true, based on 370 kps.
3) ***NO*** path momentum of reflected sunlight. MPM is false.

**The Returning Light From the Retro-reflector To the Telescope:**
1) Path momentum of light bouncing off of mirrors, light must hit two mirrors in each corner cube and each mirror must add one path momentum unit. MPM is true.

**My First Experiment:**
1) When I used a telescope, I was looking at light reflected from a piece of paper. This light clearly had to have path momentum in order for me to see a dot, thus MPM is true for reflected light.

**My Second Experiment:**
1) The light from mirrors must ***not*** have path momentum, thus MPM is false.

We thus have four major paradoxes resulting from this analysis.

**Paradox**: Because observers are able to quickly "find" the "retro-reflector" it has been shown that moon dirt (which is reflected light) ***cannot*** add path momentum to light. However, the returning light from the retro-reflector cannot hit the sending telescope unless the reflected light (from the retro-reflector mirrors) ***adds*** two path momentum units. Thus, MPM is false and MPM is true.

**Paradox**: In my second experiment it was evident that MPM was false. However, the returning light from the retro-reflector cannot hit the sending telescope unless the reflected light (from the retro-reflector mirrors) ***adds*** two path momentum units. Thus, MPM is false and MPM is true.

**Paradox:** In my first experiment, when a telescope was used to look at a paper target, it was clear that because I got a dot, that light being reflected off of a piece of paper does have path momentum. However, the light being reflected off of the surface of the moon cannot have path momentum. Thus, MPM is true and MPM is false.

**Paradox:** In my first experiment, as just mentioned, MPM must be true, or else I would not have seen a dot. In my second experiment, MPM must be false, or else I would not have seen a dot. Thus, MPM is true and MPM is false.

These paradoxes are proof that the "tilt of aberration" of lunar light is actually zero kps. This means the moon is where it appears to be when we look at it. This, by itself, is a proof that the photon theory of light is false.

These experiments on the "path of light" also prove that the aberration of terrestrial light is also zero. I could prove this directly if I had the right equipment. I could also prove that laser light does not have path momentum if I had the right equipment.

## Lunar Laser Ranging and Ether Drag

There are actually several scenarios in which the ether theory could easily explain the above paradoxes:

1) If the earth's ether drag extends beyond the orbit of the moon around the earth, then both the earth and moon would be in the same ether drag. In this case it wouldn't matter if the moon had its own ether drag, only "moving target" leads (that apply only to the orbit velocity of the moon around the earth while the laser beam is "in the air") would apply because all light between the earth and moon would be dragged together. The "moving target" lead is not aberration, it is

simply an application of the MTLs within the same ether drag. The orbit velocity of the moon around the earth is about 1 km per second. This means that in the time the laser pulse travels between the earth and moon the moon only travels about 1.25 km. This is still within the 7-km radius of the arriving laser light.

The best way to visualize how ether drag works with lunar light is to imagine a string between the retro-reflector and the telescope. The string is dragged with the earth and moon towards Leo. The string represents the path of the light beam from the moon (i.e. from the vicinity of the retro-reflector), because everything is dragged together. Thus this is the direction the telescope thinks the retro-reflector light is coming from, and thus it is also the direction the laser is pointed, and it is the path of the laser beam that travels to the moon. When the laser beam gets to the moon, this is also the direction the retro-reflector thinks the laser beam is coming from, and thus it is the direction the retro-reflector aims the light, and thus it is the path of the retro-reflector light back to the telescope.

2) If the moon had its own ether drag and if the earth's ether drag and the moon's ether drag overlapped, then the earth and moon would essentially be in the same ether drag because all lightwaves during the round trip would be dragged with the earth/moon system towards Leo. It is very similar to case #1.

3) If the earth and moon both had ether drag, and if the ether drag of the earth and the ether drag of the moon did not overlap, but their edges or boundaries were "close" to each other ("close" will be defined in a moment), then the LLR data could be explained.

4) If the moon did not have ether drag but the boundary of the earth's ether drag came "close" to the moon, the LLR data could be explained.

How "close" does the earth's ether drag need to be to the moon's ether drag (or the moon itself if the moon does not have ether drag)? It depends on whether the sun's ether drag extends beyond our earth's orbit distance from the sun. If the ether drag of the sun does not reach the earth's orbit distance, then "close" probably means less than several thousand kilometers, or else the observers would have to "lead" the retro-reflector consistently during certain times of the lunar month (this is simplified). If the ether drag of the sun does extend beyond our earth's orbit distance (which is highly likely) then there is far more tolerance for how "close" the gap (between the earth's ether drag and the moon or its ether drag) needs to be - perhaps up to a 50,000 kilometer gap.

Because LLR observers frequently need to use some "trial and error" when trying to "find" the retro-reflector, their data is not accurate enough (actually for several reasons) to determine an exact number as to how "close" the gap must be. Also, their data is not accurate enough to determine which of these options is the correct choice. However, their data **is** accurate enough to assure that one of these options is the correct choice**!**

The LLR experiments provide critical data as to how large the earth's ether drag must be in order for the LLR experiments to work. The earth's ether drag probably extends over 330,000 kilometers above the earth and the moon probably has some ether drag of its own. This height, in fact, is the best evidence that the sun's ether drag does extend beyond the earth's orbit distance.

The bottom line to all of this is that because of ether drag, the moon is exactly where we think it is. In other words, we do know the exact location of a celestial body other than the earth - the moon**!** (OK - to be technical lunar light is "old" light, but we can take that into account if we need to.)

# Chapter 11

# The Photoelectric Effect, the Compton Effect and Blackbody Radiation

"Anyone who conducts an argument by appealing to authority is not using his intelligence; he is just using his memory."
Leonardo Da Vinci (1452-1519)

## So Far

Up to this point in the book there have several proofs of the ether drag theory. But this is not the end of the debate. There are still things to understand and this chapter will deal with three experiments frequently used to prove the photon theory, or at least prove the particle nature of light (light obviously does have particle properties).

## The Photoelectric Effect

Einstein did not discover the photoelectric effect, but he did develop the formulas and published a paper on the photoelectric effect in 1905. Heinrich Rudolf Hertz (1847 - 1894) had discovered the photoelectric effect in 1887. Millikan later proved that Einstein's formulas were correct. Both Einstein and Millikan won Nobel Prizes for their work on the photoelectric effect.

The photoelectric effect involved the knocking of electrons off of the surface of metal plates in a vacuum. The classical model for ether predicted that the ***amplitude*** or intensity of light would be the determining factor in how many electrons were knocked off of the surface of the metal plate. For example, with ocean waves the amplitude of the waves is what provides the bulk of the energy. The ***frequency*** of ocean waves is fairly irrelevant in providing large amounts of energy. This is logical because the amplitude or height of several large ocean waves delivers far more water, and thus more energy, than does a larger number of much smaller waves. Thus, if ether is a wave, then some people concluded that it should be the amplitude of the waves that provided the bulk of the energy, not the frequency.

While it is common to use physical metaphors to prove or disprove a theory, one must be careful when using physical metaphors when dealing with ether, because light is an electromagnetic wave or signal, not the cumulative effect of

moving, physical particles. Thus, light is not even necessarily like sound, because light is an electromagnetic "bumping," not a physical "bumping."

What the photoelectric effect proves is that it is the color or ***frequency*** of light that provides the energy of light to knock electrons off of metal plates (for a particular type of metal), not the ***amplitude*** of the light. For example, for some metals red light will not change the electron equilibrium of the metal plates, but blue light will. The amplitude of the light is of no importance, except that if the frequency of the lightwave is in the correct range, the amplitude of the light will determine how many electrons are released.

Using the logic of the ocean example to prove the photon theory gives the impression that the photoelectric effect proves that light does ***not*** have wave properties. This is absurd. It is well known that light has wave properties and particle properties. Furthermore, if it is the ***frequency*** of light that causes electrons to get knocked off, then it is the ***wave*** properties of light that causes electrons to get knocked off (the term "frequency" and "wave" mean the same thing). The question is, is it the wave nature of ether or is it the wave nature of photons that knocks the electrons off?

What is it about this experiment that can separate the two theories? Physicists have a difficult time explaining how particles can have wave properties (e.g. Young's dual-slit experiment, Poisson's spot, etc.), and suddenly it is the wave properties of photons that are knocking electrons off of metal surfaces, but the wave properties of ether cannot**!**

Furthermore, if the amplitude of ether waves would be expected to knock the electrons off of the plates, then logically it would be the amplitude of photon waves that would also knock electrons off of the plates. Thus, if the ether theory is eliminated, then why shouldn't the photon theory also be eliminated? There is clearly a double standard in this debate, as there usually is.

But understanding the photoelectric effect, relative to ether or photons, was not fully understood until 1927, when it was discovered that electrons have wave properties. In 1923 or 1924 (depending on what event you are talking about), Louis De Broglie speculated that matter has wave properties. But it was not until 1927 that it was accidentally discovered that electrons have wave properties. I quote: "The wave nature of the electron was experimentally confirmed in 1927 by C.J. Davisson, C.H. Kunsman and L.H. Germer in the United States and by G.P. Thomson (the son of J.J. Thomson) in Aberdeen, Scotland. De Broglie's theory of electron matter waves was later used by Schrödinger, Dirac and others to develop wave mechanics."
(http://www-gap.dcs.st-and.ac.uk/~history/Mathematicians/Broglie.html)

Thus we are dealing with light, which has wave properties, and we are dealing with electrons, which also have wave properties. Thus, it is logical that in the

unique case of the photoelectric effect the frequency of the light is more important than is the amplitude of light, whether the ether or photon theory is correct.

In other words, if electrons have wave properties, they also have frequency properties. Thus it makes perfect sense that the frequency of light is what can provide enough energy to release excessive amounts of electrons from an atom, because electrons have frequency properties also.

In reality, electrons are constantly in motion and are constantly being released from a metal plate (in the experiment two metal plates are placed close to each other and they are attached via a wire and meter). Eventually equilibrium will be reached when an equal number of electrons are moving back and forth through the vacuum and through the wire. Bombarding one plate with a beam of light with the right frequency (depending on the metal) provides enough energy to release electrons and destroy the equilibrium.

Maxwell, who was one of the foremost supporters of ether in the 19th century, stated emphatically that lightwaves were electromagnetic waves, not physical or material waves, such as the ocean. Thus, why should the scientific community relate the properties of a physical wave (e.g. the ocean) to the properties of an electromagnetic wave (i.e. light), especially when electrons are involved? That is like expecting a radio signal and an arrow to have the same properties**!**

Nevertheless, there is a physical example of two frequencies joining together to accomplish some task. This is an example of a signal through air, sound, having an affect on a physical object. Light is a signal through ether, and it too can have an affect on a physical object.

It is well known that the pitch or frequency of sound can break certain types of glass. I quote from an internet site:

"First, the type of glass matters. As Louis Bloomfield of ***How Things Work*** points out, the glass usually found in windowpanes and cups is relatively soft, so it vibrates poorly and has no strong natural frequencies. If you tap a glass of this sort, all you hear is a dull "thunk" sound. There's nothing with which a high-pitched sound can resonate. Crystal is better suited because it vibrates well and emits a clear tone when you tap it. Lead oxide is added to the glass, making the resulting crystal stronger than ordinary glass. Crystal wine glasses work well for this experiment because, in addition to being crystal, they are thin and delicate, and the tubular shape enhances the sound frequency. The real trick to breaking glass with sound is to match the sound's frequency to that of the glass. You might be able to do this with a scream, but it's easier for a singer with perfect pitch to create the right note, especially if that singer's voice is amplified. Each glass will have a slightly different natural frequency due to minute variations in shape and composition. When the high-pitched sound and the glass resonate, it

causes the glass to vibrate. If the singer keeps singing the same note at high volume, eventually the glass will vibrate itself into pieces." (http://ask.yahoo.com/ask/20011212.html)

Thus, knowing that ether has frequency properties (as sound does), and knowing the electrons have frequency properties (as crystal does), we can see from the physical world that there should be no surprise that the ether theory can easily explain this phenomenon.

But let us also look at this phenomenon from a different perspective. If we assume that ether exists, then when an electron drops from one quantum level to a lower level, we know that this motion can "bump" or stimulate the ethons surrounding the atom ***at a specific frequency***. In other words, the changing of quantum levels generates a specific frequency wave of light.

Therefore it stands to reason that the reverse is also true. The frequency of light can cause electrons to change quantum levels. In fact, we know that it is true because atoms absorb energy from ethons under the right conditions. Since an electron is freed from an atom when it jumps to a quantum level that doesn't exist for that type of atom, it makes perfect sense that the frequency of light is what dislodges electrons from atoms.

(Note: In stating the above paragraphs, it should be emphasized that it is not known whether the electron drop "bumps" the ether or whether it is the energy in the ether that causes the electron to drop down. In terms of bumping the electron up, it is most certainly the ether that initiates this event.)

In reality, the discovery that electrons have wave properties is just one of the many discoveries that should have reopened the ether-photon debate, but of course it did not.

## The Compton Effect

The Compton effect is a little more complicated. It involves the scattering of electrons and the resultant wavelengths associated with the angles beyond the collision.

I quote from the well-known book on light by Ditchburn:

"Compton's original experiments deal with ***average effects*** due to ***large numbers*** of collisions. They cannot, therefore, give direct evidence concerning the change of momentum ***in a single collision***. ... It is possible to obtain the change of wavelength from a purely wave-theory [ether] by assuming that the scattering is a double process in which the light is absorbed and is then emitted

by the moving electron. The change of wavelength is then ascribed to the Doppler effect." [italics, underline added][29]

In fact, whether the photon or ether theory is correct, the electrons jump off of the metal because of intense localized energy (e.g. heat). What generates this intense energy can be explained by either the photon or ether theory.

To better understand how, let us consider an example from the sports world.

## The Pool Table Example

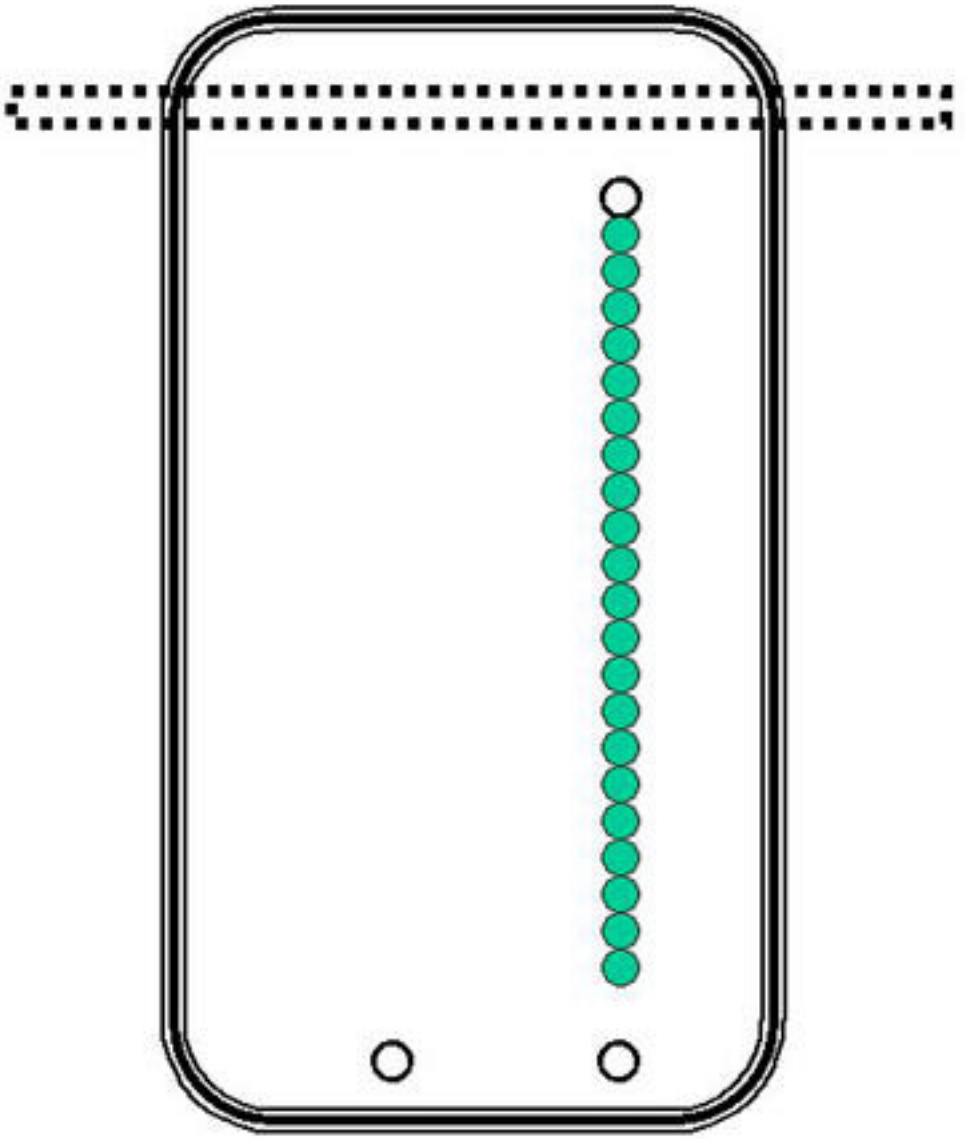
Image a pool table that is one hundred feet long and five feet wide. Suppose there is a straight line of pool balls, each touching the other, on one side of the table on the long axis. This line of pool balls goes from within one foot of the near side of the pool table to within one foot of the far side of the pool table. In other words, the line of pool balls is ninety-eight feet long.

Now image that there are two cue balls on the near end of the table, three inches from the near cushion. One of the cue balls is lined up with the long line of pool balls and the other one has no pool balls between it and the far cushion, almost a hundred feet away. Let us assume that the last of the pool balls in the long line of pool balls is also a cue ball.

Let us assume the cue ball in the long line of pool balls is hit by a man, and the other cue ball is hit by a woman. The cue ball that is hit by the male pool player only goes a few inches, but the last of the pool balls in the long line, which is also a cue ball, hits the far cushion.

Now suppose there is a curtain at the far end of the pool table that is six inches from the far cushion, such that no part of the pool table can be seen (by someone behind the curtain) except for the last six inches of the pool table.

See the graphic on the next page:



Given the same amount of energy from the two pool players, the long line of pool balls will cause a ball to hit the far cushion much more quickly than the cue ball that has to travel the entire distance. And with more energy, given the same hit of the two pool players.

Now let us suppose there is a judge at the far end of the pool table who can only see the last six inches of the pool table because of the curtain. Now suppose that the two pool players each hits their cue ball at such an energy level and with such timing, that both the woman's cue ball and the last of the pool balls in the long line, which is also a cue ball, hit the far cushion at exactly the same time and with the same energy level (i.e. the same velocity in this case).

How can the judge behind the curtain tell which cue ball was hit by the man (i.e. the cue ball that resulted indirectly from the man's hit) or was hit by the woman? The judge cannot tell.

The long line of pool balls (i.e. the "wave") obviously represents the ether theory of light. The single cue ball (i.e. the "particle") hit by the woman represents the photon theory of light.

This simple example contains a very profound message: since the long line of pool balls (the "wave") is ***composed exclusively of "particles"*** (i.e. pool balls), the long line of pool balls has "particle" properties identical to the "particle" properties of the cue ball hit by the woman**!** In fact it is impossible to tell which pool ball is the "wave" cue ball (from the long line of pool balls) or which is the "particle" cue ball (the cue ball that travels the entire distance).

Of course, the actual "bumping" of contiguous ethons is exclusively electromagnetic, not physical, thus the many properties of pool balls and ethons, such as the dispersion properties of pool balls versus light, would not necessarily be the same.

But there is another serious problem with the Compton Effect:

## Problems With Determining How Light Travels

If an equal amount of energy is observed resulting from the two pool players (at the far cushion), it is impossible for the judge to distinguish between which energy level resulted from the "wave" of pool balls and which resulted from the "particle" cue ball. But what if the judge could observe the energy applied by both the man and the woman, and the judge could observe how much energy is applied to the far wall?

For example, if both the man and the woman hit their respective balls with an equal amount of energy, then the amount of energy at the far wall will be stronger for the long line of pool balls. Thus, if the judge knows that both cue balls are hit with the same energy level, and if the judge understands that one cue ball travels the entire distance by itself, and the other cue ball hits a long line of pool balls, then the judge, based on his own experiments, can tell which side of the table the long line of pool balls is on**!**

Likewise, if the judge knows that both energy levels at the far cushion are equal, but the judge knows how much energy, and when, each pool player hit their respective cue ball, then the judge can tell which side of the table has the long line of pool balls.

In short, because the long line of pool balls is more efficient than the single cue ball, that has to travel the entire distance by itself, then knowing how much energy is exerted and how much energy is measured at the end of the table will tell the judge which side of the table has the long line of pool balls.

With this in mind, it should be easy to determine whether light travels by photons or ether. Unfortunately, it is not as easy as it sounds.

With the pool table example, we can do simple experiments to determine, under specific conditions, just how efficient the long line of pool balls is, compared to the woman's efforts. We don't have that luxury with light because we cannot calculate how efficient ether would be compared to photons because:
1) If ether exists, we cannot create photons for our experiments, nor can we create an "ether vacuum" for our photons to travel through, or
2) If photons exist, we cannot create ether for our experiments.

In other words, we cannot compare them both side-by-side because both of them do not exist. To elaborate, whether light travels by photons or a chain reaction inside of ether, the energy that hits an atom (such as in the Compton Effect) is an "electromagnetic" energy, not a physical or mechanical energy. It is also a wave, since photons are claimed to have wave properties also. How is it possible to theoretically calculate the efficiency of an electromagnetic jolt from a free flying particle (i.e. a photon) versus an electromagnetic jolt from a chain reaction of charges that travel in the ether? We only have a single final number, but that single final number does not tell us anything because we have no number to compare it to.

As with the photoelectric, there is really nothing about the Compton Effect, except assumptions, that helps us determine whether light is a particle or a signal.

## Blackbody Radiation

In the photon theory of light, each photon is a small “light quanta,” or particle of light. Thus each photon is discrete in nature. One of the experiments that was felt to demonstrate the discrete nature of light energy was the "blackbody radiation" or "cavity radiation" experiment.

The blackbody radiation experiment consists of a metal box, completely enclosed, but with a small window on it so someone can see inside. The box is slowly heated up and the observer can see the colors in the box change as the box heats up. The term "blackbody" refers to the color of the inside of the metal box, the term "radiation" refers to the light that is emitted as the box heats up.

The phenomenon of blackbody radiation was not discovered by Max Planck, in fact he was not the first person to work on the formulas for blackbody radiation. Many scientists studied the blackbody radiation experiments, but no one was able to come up with a formula that would accurately predict the entire frequency distribution of the blackbody spectrum for any temperature.

The first to have some success at predicting this distribution were John Rayleigh and James Jeans. The Rayleigh-Jeans formula was based on classical theory. The formula worked well for the lower frequencies, but since they used an exponential function, the function did not work well at the higher frequencies. This is because a typical blackbody radiation distribution curve looks like a distorted "bell" curve, thus at the higher frequencies, instead of an exponential rise, the curve drops.

Their formulas were vastly improved by Wilhelm Weir, whose formulas worked well at the higher frequencies, but were not exactly correct at the lower frequencies. Max Planck made a very minor, but profound, change to the Weir formula and was successful at matching the entire frequency distribution.[22-Chapter 4]

But a formula does not explain "why" something happens the way it does. Upon a great deal of further analysis, Planck concluded that the formula worked because light had quantum or discrete energy levels (i.e. he concluded that light ***frequencies*** are continuous, but their ***energy levels*** are discrete). His discovery was not well received at first. But Einstein took him seriously and came up with the "little box" thought experiment to justify both his own belief in photons (according to some researchers Einstein had disavowed the ether theory in the 1890s) and the discrete nature of light that Planck had discovered.

Einstein pictured in his mind a "little box" that had a small hole in one side, that was placed inside of Planck's big blackbody radiation box. Einstein imagined that individual light particles randomly went into and out of this "little box," thus

creating discrete energy levels within ***the little box***. In other words, if there were only a handful of photons in the box, the movement of a single photon into or out of the little box would cause discrete changes in the energy level inside the box (I am simplifying his arguments).

As a purely academic matter, Einstein's "little box" would have to be much smaller than a single hydrogen atom, and perhaps smaller than a single electron, to contain only a few photons. If the "little box" was one cubic centimeter (and the hole was proportionally sized), many, many photons would be going into and out of the little box at any given time. In this case the movement of a single photon would not have been detectable by Planck.

In other words, Planck's crude equipment could not detect the movement of a single photon; it could only detect the average, simultaneous motion of many, many trillions of photons. And even then, it was the formula, not any observed phenomenon by Planck, that pointed towards discrete energy levels. In other words, the discrete nature of photons could not have been the cause of the discrete energy in the experiment because there were far too many photons (assuming the photon theory) for his equipment to detect the result of the motion of individual photons.

To understand more about discrete energy levels, let us continue the pool table example. Let us suppose there is a machine that can hit cue balls. Suppose this machine has a finite number of settings, say 100 different energy settings. In other words, the machine can only hit a cue ball with one of 100 different energy levels.

Let us put this machine behind the cue ball that is lined up with the long line of pool balls. Here is the question: "how many different energy levels will be observed by the judge at the far end of the table if we use the machine to hit the cue ball lined up with the long line of pool balls?" If the machine has 100 settings, the judge will only observe 100 different energy levels of arriving cue balls, even if we do the experiment a million times.

If atoms only generate a finite number of energy levels, meaning if there are only a finite number of possible electron drops from high quantum levels to lower quantum levels, then why would anyone expect that if light travels via ether that light would have a continuous number of different energy levels? It is interesting that light has continuous wavelengths, but there are only a finite number of possible quantum drops.

There are three items that control whether a type of energy is perceived to be continuous or discrete:

The
**1) "energy source"** generates the energy (i.e. the electrons in atoms) and transfers the energy to an ...
**2) "energy carrier,"** which carries and transfers the energy (i.e. the photon or ether) until an ...
**3) "energy detector or absorber"** calculates or absorbs the arriving energy level (this would be a spectroscope in the case of Planck's blackbody radiation experiment).

If all three of these items can handle continuous energy, then the energy detector ***may*** observe continuous energy levels (i.e. the formula that describes the resulting distributions may be consistent with continuous functions). If any one of these items can only handle discrete or finite levels of energy, then only discrete energy levels, meaning a finite number of energy levels, will result.

Einstein focused his attention on the "energy carrier," however; it is currently accepted that the "energy source," namely atoms, can only provide discrete energy levels. Thus, even if a photon or an ethon could carry a continuous number of energy levels (and why couldn't they?), only a discrete or finite number of energy levels would be observed whether light travels by photons or ether.

It is absolutely incredible that blackbody radiation was used as a "proof" of the photon theory when Bohr's model for quantum electron levels (1913) was developed long before the photon theory was accepted in 1924. At the time Bohr came up with his first model, the ether theory was still well entrenched in the scientific world. Thus it should have surprised no one that the "energy source" was a discrete energy source, and thus it should be expected that discrete energy levels would be observed. How can a discrete energy level be converted into a continuum? It can't unless there are averages of many, many individual events.

No matter whether light is photons or ether, what goes on inside of the blackbody box involves many, many photons or many, many signals, thus how does blackbody radiation prove anything about light?

Is it possible a particle can "carry" a continuous number of energy levels? We just saw that with the pool table example. If a human hits one of the cue balls, a continuous number of energy levels will be transferred by either of the cue balls. On the other hand, if a machine with only a finite number of energy levels hits either of the cue balls, then only a discrete number of different energy levels will be transferred by either cue ball.

Let us look at another wave example. Let us consider a guitar being played by a robot. Suppose the robot has the ability to pinch or press the guitar strings

anywhere on the "neck" of the guitar (i.e. at a continuous number of points). But suppose the robot can only pluck the strings with any one of 20 different energy levels. In other words, the robot can play a continuous number of different frequencies but only with a finite number of different energy levels.

We now have these items to consider (in parenthesis is a note whether this item can handle a "discrete" or "continuous" number of frequencies and energy levels):
1) The robots "fingers" (discrete energy levels, continuous frequencies),
2) The guitar strings, which is the "energy source" (continuous wave for both, if played by a human),
3) The air, which is the "energy carrier" for sound (continuous wave for both), and
4) Our ears, which is the "energy detector" (continuous wave for both).
Every item in the list can handle a continuous number of different frequencies and energy levels, except for item number one.

But note in this case that it is not the "energy source" (i.e. the strings), nor the "energy carrier," (i.e. the air), nor the "energy detector" (i.e. our ears) that causes the discrete number of different energy levels! All three of these things can handle continuous energy levels and continuous frequencies. It is something related to the experiment (i.e. the robot) that causes the discrete energy levels. Thus we see that there is a fourth thing that can cause discrete energy levels - the physical facilities and environment of the experiment.

Suppose, for example, that atoms (the "energy source") can create continuous energy levels (which they apparently can't) and that photons or ethons can carry continuous energy levels and that the spectroscope can handle continuous energy levels. Is there a possibility that some physical aspect of the blackbody experiment itself caused the discrete energy levels?

With all of this in mind, I quote from an email I received from Dr. Howard C. Hayden, Emeritus Professor of Physics, University of Connecticut, and former Editor of Galilean Electrodynamics:

"Thermodynamicists looked at the blackbody curve (the data) and noticed the similarity to speed distributions in a gas. They tried to rig up a similar model to explain the blackbody curve. Nothing worked. One model fit the data at the red end of the spectrum but would end up with the ultraviolet catastrophe (infinite power at that end of the spectrum). Another model fit the blue end but failed at the red end. Along came Planck. Textbooks say he invoked E=nhf, but I don't think that's what he was thinking. It is more reasonable, to me at least, that he regarded the cavity as a resonant cavity, in which the diameter would be one wavelength, two wavelengths, etc., corresponding to f, 2f, 3f, etc. The BASIC physics he was using was resonance, and the DERIVED physics was E=nhf, where the f is merely the lowest frequency; more generally it would be E=hf. When Einstein proposed his solution for the photoelectric effect, Planck objected

strenuously. The objection is obvious. Planck never meant for the E-M field to be quantized outside the cavity. Bohr seized upon Einstein's idea as a way to explain the hydrogen atom. So, in the picture you paint, the metal in the photoelectric effect is a quantum system, and the hydrogen atom is also. However, there is no reason for the E-M field itself to be quantized. At the very least, the experiments do not prove that it is."

# Chapter 12

# Is the Speed of Light a Constant?

"It is impossible to travel faster than the speed of light, and certainly not desirable, as one's hat keeps blowing off."
Woody Allen

## Introduction

(Special thanks to Dr. George Marklin for a key concept that made this paradox possible.)

Special Relativity ("***SR***") states, as its second postulate, that the "[***apparent***] speed of light" is the same for all observers. If the observers have adequate equipment, we must assume that Einstein meant: the "***measured*** speed of light" is the same for all observers.

In a sense we are in the same situation we were in when we discussed the first postulate. In the 1905 version of the SR it essentially talked about "***imaginary time***." This "imaginary time" was replaced with "***actual time***" long before 1971. Since there is no point in talking about the "***imaginary speed of light***," we will do exactly the same thing we did with the first postulate and instead talk about the "measured speed of light."

Let me present a paradox to the second postulate in the SR. I will call this the "***Three Space Ship Paradox***."

## The Setup of the Experiment

Let us assume there are three space ships. Each of these space ships has exactly the same capabilities. Let us further assume that all three of these ships are traveling in open space, half-way between two galaxies, and all velocities are measured relative to Cosmic Microwave Background Radiation or CMBR. Let us pick a reference point, relative to CMBR, and call it Point N, that is a point half-way between two galaxies. Even though the galaxies are moving relative to CMBR, this point is not moving relative to CMBR. Point N is perfectly at rest, relative to CMBR, during this entire experiment.

Let us also define a flat 2D plane that is "at rest" relative to Point N, 1 light year in radius, with center at Point N. Let us further draw a "***straight line***" from Point N

to the edge of this flat 2D plane. This line is also perfectly "at rest," relative to CMBR and Point N, during the entire experiment. Obviously, the straight line forms a visual radius for the flat 2D plane. Now let us pick a point that is 1/2 light year from Point N, and is on the "straight line," and thus on the flat 2D plane, and call it Point C. From Point C, we will pick a point 1/4 light year "above," and normal to the flat plane at Point C, and call it Point A.

Now let us define some directions. Using Point A as a reference point and vantage point, and looking "down" at Point C, and also looking "towards" Point N," we will define that a space ship that is headed directly towards Point N, and is on the straight line, is headed "North." Obviously, if a ship were headed away from Point N, and were on the straight line, it would be headed "South."

Again using Point A as a reference point, any ship traveling on the plane that is headed perpendicular to the straight line, and is headed from right to left is headed "West" and any ship traveling in the opposite direction is headed "East." This completes our coordinate system. Point A will be our vantage point for the rest of this experiment.

On the top of each of the three ships is a painted circle that is 100 meters in diameter. On this circle is drawn a line, from one end of the circle to the other, passing through the center point of the circle, such that it is parallel with the direction the ship moves when it is moving "forward." In other words, as the ship is moving forward, the line is parallel to the direction vector that the ship is headed. A second line is drawn on the circle that is perpendicular to the first line and also crosses the center of the circle. The two lines form a "cross," with its center at the center of the circle. At the four endpoints of these two lines is put a short stick, vertical or normal to the 2D plane formed by the circle painted on the ship.

We will number these four sticks. The stick that is on the first line, and at the front of the ship, as it heads forward, is called Stick 1. The sticks are numbered consecutively, clockwise, around the ship.

Let us now think about how the speed of light is measured. We first calculate how far the light travels, call it 'd', for distance, and we measure how much time it takes to travel that distance, call it 't', for time. We use the following formula: $c = d / t$

In each of the three ships we will measure how long it takes photons (assuming the photon theory) to travel between two of the sticks. We will use very accurate atomic clocks to measure the time, t, it takes the photons to travel between the two sticks on each ship.

Ship 1 is traveling at exactly 90% of the speed of light. It is traveling "Northbound," towards Point N, 1,000 meters ***below*** the flat 2D plane and

directly beneath the straight line. Ship 2 is also traveling at exactly 90% of the speed of light. It is traveling "Southbound," away from Point N, directly on the flat 2D plane. Ship 3 is traveling "Westbound" (from the vantage of Point A), 1,000 meters ***above*** the flat 2D plane.

First of all, let me point out that the atomic clocks on all 3 ships are recording "time" exactly the same. This is because all 3 ships are traveling at exactly the same velocity relative to Point N, which is stationary relative to CMBR. This comment requires some explanation.

With the Hafele-Keating experiment, the direction the jets headed was significant to their velocity relative to the "at rest" reference point. However, the direction of the jets was important only because the jets were carried with the surface of the earth in its daily rotation. It was the rotation of the earth that made their direction important.

In the case of the Three Spaceship Paradox, direction is not important because there is no rotating planet that is affecting their net velocity relative to Point N. Relative to Point N, all three ships are traveling at exactly the same velocity. Thus, the atomic clocks, and the people inside of the ships, are all measuring time identically. We will also synchronize all of the clocks, meaning not only are all three ships measuring (a change in) time identically, but all of them are recording exactly the same time.

## The Experiment Begins

A single pulse of laser light is sent from Point N along the straight line. It is 4,000 meters in diameter when it arrives at Point C. At the exact instant the beam arrives at Point C. the ships are positioned (as they are in motion at 90% of the speed of light) such that this light simultaneously hits the "***first stick***" (i.e. the closest stick of each ship to Point N) of each space ship. In other words, in Ship1, the laser beam hits Stick 1 first. In Ship 2 it hits Stick 3 first. In Ship 3 it hits Stick 2 first. Obviously, our concern is how long it takes this light to hit the "***second stick***" (i.e. the stick at the opposite end of the same line the "first stick" is on) of each ship. For Ship 1 the "second stick" is Stick 3. For Ship 2 the "second stick" is Stick 1. For Ship 3 the second stick is Stick 4. By design, even though all three ships are traveling at 90% of the speed of light, they all arrive at Point C, such that, at exactly the same instant the light hits the "first stick" of each ship.

Now comes the question, will all three ships measure the same speed of light? This question is equivalent to the question, will it take the same amount of time for the light to travel from the "first stick" to the "second stick" for all three ships?

To answer that question, we must think about the MTLs. Since the beam of light hits the "first stick" of all three ships at exactly the same instant, and all three atomic clocks are synchronized, we can use this instant in time to start the MTLs operating. In other words, the "second stick" is the "target" and it is a moving target. Thus, we are concerned with how much the target (i.e. the "second stick") moves while the laser beam is "in the air," meaning while the beam is traveling from the "first stick" to the "second stick."

When the MTL is started, in the time it takes the light beam to travel to the second stick in Ship 1, the second stick is moving ***towards*** that light at 90% of the speed of light. In the time it takes the light beam to travel to the second stick in Ship 2, the second stick is moving ***away*** from that light at 90% of the speed of light. In Ship 3, the second stick is moving ***perpendicular*** to the light beam path at 90% of the speed of light, and the light beam will miss the second stick, but other light beams from the same laser will hit the second stick.

When the speed of light is calculated, ***the motion of the two measuring points, relative to CMBR, is <u>not</u> taken into account***. In other words, if I were measuring the speed of light in a laboratory in Overland Park, Kansas, USA, I would measure the speed of light based on how much time it took the light to travel between two fixed points in the lab. Let us say the two points were 100 meters apart in the lab. I would not take into account the velocity of the earth towards Leo, the orbit velocity of our earth around the sun, or any other factor. I would always use "100 meters" as 'd'. Likewise, when the people on all three ships measure the speed of light, the 'd' that they use will also be 100 meters on all three ships.

However, our concern here is not how far it is between the two sticks relative to the occupants of the ships, but how far the light has to travel ***relative to CMBR*** before it hits the "second stick**!** The people in the space ships may have no idea how fast they are traveling relative to CMBR, they are only interested in how much time, t, it takes the light to travel the 100 meters, d, the distance between the "first stick" and the "second stick."

Let's do the math (assuming the speed of light is exactly 300,000 kps):

First, let us calculate how much time it takes the laser pulse to travel the 100 meters, d, in Ship 1. Ship 1 is headed "North," directly towards Point N. Thus, with a simple amount of mathematics, the light only travels 52.63 meters (relative to Point N) before it hits the second stick, meaning it takes 0.0000001754333 seconds to travel between the two sticks. The people on Ship 1, who know nothing about CMBR, will calculate the speed of light, c, as: 570,017.1 kps because from their perspective the light travels 100 meters.

Second, let us calculate how much time it takes the laser pulse to travel the 100 meters, d, in Ship 2. Ship 2 is headed "South," directly away from Point N.

Thus, with a simple amount of mathematics, the light travels 900.00 meters (relative to Point N) before it hits the second stick, and it takes 0.000003 seconds to travel between the two sticks. The people on Ship 2 will calculate the speed of light, c, as: 33,333.3 kps.

Third, let us calculate how much time it takes the laser pulse to travel the 100 meters in Ship 3. Ship 3 is headed "West," perpendicular to the straight line that emanates from Point N. In this case the same photons (assuming the photon theory) that directly pass over the first stick will not hit the second stick. But this does not matter because other portions of the same laser beam will hit the second stick. To simplify things, I will consider the "first stick" and the "second stick" to be infinitely wide, and perpendicular to the straight line, and will simply measure the time it takes any of the photons to pass between these two infinitely wide sticks. By definition the people in Ship 3 will calculate the speed of light, c, as: 300,000 kps.

Since the atomic clocks on all three ships are synchronized, and because they all measure time the same way, and because they are all traveling at the same velocity relative to Point N, and because all of them use 'd=100', the only variable is how long it takes the light to travel between the two sticks of each ship, which is 't'. It is clear that the time that it takes the light to travel between the two sticks will be different for each ship. Thus we must conclude that ***c will be different for each of the 3 ships***.

The postulates of Special Relativity are assumptions, not laws. The MTLs are laws. We must give priority to laws that are proven, rather than to assumptions which are not proven.

Thus, we have no choice but to conclude that the speed of light cannot be the same for all observers. In fact, even with the ether theory the same results would be obtained, since we are measuring c from the perspective of each ship.

# Chapter 13

# General Relativity and the Ether

"Classification of mathematical problems as linear and nonlinear is like classification of the Universe as bananas and non-bananas."
Unknown

## Altitude and the H-K

As far as the H-K is concerned, General Relativity ("GR") is concerned with gravity. Gravity, of course, is stronger near the surface of the earth as opposed to at high altitudes. The intent of this chapter is to explain how ether and ether drag can logically and easily explain the "altitude" or GR portion of the H-K experiment. Other topics will also be discussed.

Hafele and Keating predicted, because of GR, that at higher altitudes the atomic clocks would operate at a faster speed. And, of course, they were right. At the higher altitudes, gravity is less potent, and the atomic clocks actually measured time faster than time measured at ground level. Other experiments have also verified this.

It should be remembered that these are "actual time" changes. The direction of the flights had no affect on the GR portion of the data.

Sometimes an experiment gives us clearer insight into a phenomenon. Tesla described ether much like a person would describe a hydrogen gas atom. Whether this is right or not, it is important to know whether ether is compressible and whether it is compressible by the earth's gravity? The Hafele-Keating experiment gives us the answer. Since the atomic clocks operated faster at higher altitudes, it is logical to say that there is less resistance (i.e. FROS) to the cesium atoms at higher altitudes. Thus, if the FROS is less at higher altitudes, the density of ether must be less at higher altitudes. This means that the density of the ether is a function of gravity. This, in fact, makes perfect sense when thinking about the Tesla model of ether. Certainly, our atmosphere is the key, both our atmosphere (i.e. the air) and ether "thin out" at higher altitudes.

Since the density of ether is directly proportional to the strength of gravity (this is not an accident, it is a clear "cause and effect" relationship), it is clear that the FROS formulas for altitude would be similar, if not exactly the same, as the GR formulas for altitude (at least as far as measurable and verifiable formulas are

concerned). The variation of density by altitude is also a strong indication that gravity is what is holding the ether drag to the earth.

It should be mentioned, however, that the "density" of ether may not be a matter of ethons becoming ***physically*** further apart at the higher altitudes. It may be an issue of energy. For example, if gravity energizes ether (or vice versa), the ethons may be the same physical distance apart at higher altitudes, but the energy levels of the ethons may less, and thus provide less resistance to the electrons in the atomic clocks at higher altitudes.

In any case, Hafele and Keating did make a major discovery in their experiment, but it was not the one they thought they had made. They discovered that the "density" of ether varies by altitude and thus FROS varies by altitude and thus "time" varies by altitude.

## Can Ether Be A Solid?

While the reader may think that this book favors the theory that ether is a gas, such is not the case. Is ether a gas or a liquid or a solid? The answer is probably "none of the above."

Knowing that ether drag exists, how could ether be a solid? The answer is that if ether were a solid, the earth's gravity could locally "energize" the ether as it travels through the ether, thus giving the illusion that there is physical ether drag. But there is a problem with this theory as I will now explain.

In this discussion, the reader must keep in mind the difference between ***ether*** (i.e. "ethons") and the ***signal*** traveling through the ether (i.e. light). This is similar to separating in our minds the difference between "air" and "sound."

Consider a fiber optic cable that spans 100 kilometers. During the time the fiber optic ***signal*** is traveling down the fiber ***cable***, the earth and the fiber itself are moving towards Leo at 370 kps. If ether were a solid, the earth and the fiber optic cable would be traveling through the ether at 370 kps. We know that the ***signal*** does not travel with the earth towards Leo, or else the signal could not stay inside the cable for 100 km. But it is possible that the ***signal*** does stay within the cable, while the cable itself travels through the ether at 370 kps.

This is difficult to understand so let me provide a metaphor. Suppose you have a long cylinder of chicken wire (chicken wire is mostly air, the wires are very thin and are very far apart), which has a radius of 1 meter and a length of 100 km. Suppose this chicken wire is towed underwater by two tug boats at 10 kph. The tube of chicken wire is perpendicular to the direction of the tug boats. While it is being towed, someone shoots a water balloon down the length of the chicken wire at 30 kph. The chicken wire (i.e. the fiber optic cable) will travel through the

water (i.e. the ether) as if the water wasn't even there. However, the water balloon (i.e. the signal) is confined to stay within the chicken wire. It cannot leave the chicken wire. This is an example of how to separate the ether (i.e. the water) from the signal (i.e. the water balloon). The mirrored surface inside of the fiber optic cable would act as the chicken wire. It would contain the signal, but would travel through the ether as if it weren't there.

Thus, if there were no physical ether drag (i.e. ether was a solid), the cable (i.e. the chicken wire) would be traveling through the ether (i.e. the water) at the same speed as the planet. However, the signal (i.e. the laser beam) would be confined to staying within the fiber optic cable (i.e. the chicken wire).

However, if a laser is fired in open-air there would be no mirrored fiber optic cable to contain the signal. It would make sense that the signal would attach itself to the ether, which is assumed to be a solid in this case. If so, we could easily detect that the signal is attached to the ether, not the earth (i.e. not to the fiber that is attached to the earth). In my first experiment, if this were the case, I would have clearly gotten an ellipse**!** But my experiments make it clear that the signal is not attached to the ether (this discussion is assuming that ether is a solid). It is for exactly this reason that I personally reject the theory that ether is a solid (at least the ether that light travels through as a signal, there may be other kinds of ether). It makes logical sense that in open-air the signal would attach itself to the ether, not the earth, even if the earth energized the ether particles as it passed by them. In any case, that is my opinion.

The priority of this book is to deal with the existence of ether, not to speculate as to "what" it is. This book will refer to ether as a gas or liquid (i.e. fluid), but this is only for convenience.

# Chapter 14

# Aberration and Ether

"Those are my principles. If you don't like them I have others."
Groucho Marx (1890-1977)

## Introduction

One of the most controversial issues during the ether vs. photon debates of the early 1920s had to do with ether and aberration of starlight. Because of the null result of the MMI, ether drag had to be considered. However, since ether drag dragged the light from stars with the earth, it was felt by some that there would be no aberration of starlight if the ether drag theory were true. This chapter will be somewhat speculative, but between the two theories that will be presented, the truth is likely to be found.

There is almost no doubt that aberration of starlight with the ether drag theory involves the apparent or actual bending of light at the boundary, meaning outside edge, of the ether drag. Lunar Laser Ranging experiment demonstrate that the ether drag extends many tens of thousands of miles above the earth's surface. It is at the outside surface or boundary of the ether drag that aberration of starlight must occur. In fact this theory was mentioned by Stokes as early as 1845.[6] Stokes theory, viewed today, is more of an explanation of "atmospheric refraction," which will be discussed in the next chapter, but he understood that aberration of starlight did occur at the boundary of the ether drag and continued as the light passed through the ether drag.

There are two basic theories that will be discussed in detail. Briefly, the first one is that the bending of light at the boundary of the earth's ether drag is an ***apparent*** bending, and only appears to bend to those inside of the ether drag. The second theory is that the bending of light at the boundary of the earth's ether drag is an ***actual*** bending of light. It is also possible that a combination of the two theories is the correct choice.

## Moving Medium Laws (an Apparent Bending)

First, we must discuss how big the sun's ether drag is. Does the sun's ether drag extend beyond the earth's orbit distance from the sun? Based on Lunar Laser Ranging experiments, considering how high the earth's ether drag must be, the answer is that it is highly probable that the sun's ether drag does extend well

beyond our earth's orbit distance from the sun. This will be assumed in this chapter.

This means that the earth is orbiting the sun inside of the calm ether ocean of the sun's ether drag. This means that the aberration of starlight at the boundary of the earth's ether drag, is based ***solely*** on our earth's orbit velocity around the sun. This also means that the bending of light for secular aberration (apparent or actual) occurs at the boundary of the sun's ether drag, many millions of miles from the earth. This means that total aberration occurs in two phases: first at the sun's ether drag boundary for secular aberration, and second, at the earth's ether drag boundary for stellar or annual aberration (actually, the USNO almanac included secular aberration as a part of the definition of stellar aberration, but I am separating them because they probably occur at two different locations).

Whatever causes the bending of light at the boundary of the earth's ether drag is also causing the bending of light at the boundary of the sun's ether drag. Thus, we will only talk about the earth. (Note: It is possible that the galaxy also has a type of ether drag, thus the bending of light at the boundary of the sun's ether drag may not be based on our solar system's total velocity in space.)

Let us consider a beam of light from a distant star as it comes into contact with our moving ether drag, I say "moving" because we are orbiting the sun at 30 kps, thus the ether drag is moving relative to a light beam from a distant star. Suppose the beam enters this ether drag perpendicular to our path around the sun (i.e. to our ecliptic plane) and perpendicular to the earth where we are standing (technically this beam is normal to our horizon plane - the 2D plane tangent to where we are standing). Let us consider how different observers view this beam of light.

The first observer travels with the beam of light, but he stops and stays stationary just before the beam enters our moving ether drag. This person waits above our earth and watches the path of the light from directly above the earth until the light hits the earth or passes by the earth. Even though our ether drag is moving (i.e. our earth is moving), this person may notice that the light travels in a straight line, whether it hits the earth or not. The beam may, by nature, travel in a straight line (as seen by this first observer) even when it hits a moving medium such as ether drag.

To visualize how this can happen, the "***Moving Medium Laws***" will now be described. To understand how they work, do this mental exercise. Consider a 5 meter tall sphere made of chicken wire (chicken wire is mostly air, the wires are very thin and are very far apart). Suppose that in the middle of this chicken wire sphere is a soccer ball that is rotating. Now suppose that the entire interior of this chicken wire sphere (except for the soccer ball) is a chicken wire array or grid. In other words, every cubic meter of this chicken wire sphere is filled with a 3 dimensional grid of chicken wire.

Now image that this chicken wire sphere is placed on a flatbed car on a train and that the train is traveling at a constant 70 kph. As this train is entering a tunnel, someone standing on top of the tunnel (this is the person just mentioned that stops before the light gets to the ether drag) drops a single, but large, drop of water straight down at the train. The release of this drop of water is timed so that it hits the very top of the chicken wire sphere just before the flatbed car enters the tunnel.

This observer standing above the tunnel (who is equivalent to the first observer above), who drops the drop of water, notices that the drop of water travels in a perfectly straight line whether it hits the soccer ball or the flatbed car.

A second observer is standing a hundred meters away from the train; he is standing on the ground. If this person focuses only on the drop of water, he will observe that the drop of water moves in a straight line until it hits the soccer ball or the train.

However, if this second observer focuses only on which wires inside of the chicken wire sphere are touched by the drop of water, he will notice that a pattern emerges. A string drawn between the places where the drop of water hits the chicken wire grid forms a straight line that ***angles*** in the opposite direction that the train is headed (using the top of the sphere as the beginning reference point).

A third person, sitting on the flatbed car and ***moving with the train***, exactly where the drop of water finally hits the flatbed car, will think that the drop of water is coming down at an angle. To understand why this is so, note that the string just mentioned represents the path of the water drop relative to the chicken wire grid. Because this person is moving with the train, she will think that the drop has come down at an angle because she will see the path of the water drop relative to the chicken wire grid. Since the observer sitting on the flatbed car sees the direction the water drop appears to come from, she would see the water drop coming in at an angle, not from directly above. In fact, the angle formed by the string would be the exact angle she would see the drop of water coming in from. The "bend" of the drop of water is both apparent, to those moving with the train, and occurs ***exactly*** at the boundary of the chicken wire. Once inside the chicken wire, the drop travels in a straight line relative to the wire and string, but it travels at an angle.

The third person is equivalent to an astronomer that is inside of the ether drag. Since the light bends in the opposite direction of the path of the earth (starting from the top of the sphere), it is clear to her that to align her telescope with the light beam that reaches her, she needs to tilt her telescope in the same direction that the earth moves.

With this theory, the tilt of the telescopes is needed because the bending of light is caused by the moving ether drag surrounding our earth, meaning the "moving medium." The tilt is not due to the motion of the telescope while a photon travels from the top to the bottom of the telescope. The bending of light starts to occur at the boundary of the ether drag (i.e. at the top of the chicken wire), long before the light gets to the telescope.

Thus there are three observers of this drop of water. Two of them see it travel in a straight line. The third observer, who is moving with the train, sees it come in at an angle. The same phenomenon would occur for aberration of starlight in the Moving Medium Law scenario.

Likewise, if there were a fourth person laying ***stationary*** on the train tracks, directly underneath where the water was dropped, because this person is not moving, he would see the drop of water travel in a straight line, meaning directly from above. I make this note because of occultations, which will now be discussed.

One might wonder if there is any evidence that the Moving Medium Laws might be valid and that the bending of light is only an apparent bend to those inside of the ether drag. The answer is yes, and as might be expected, it comes from astronomy. If the earth has ether drag, then so does Jupiter. Jupiter's ether drag would be much denser than our earth's on its surface and it would have a much higher altitude of ether drag than the earth's.

The light that comes from a star, and passes next to Jupiter on its path to us, must pass through the ether drag of Jupiter. Thus, we are the "fourth person" mentioned above relative to the train example (i.e. we are underneath the train and are stationary relative to the ether drag of Jupiter).

In astronomy there is a phenomenon called "***occultation***." An occultation basically occurs when one celestial body (always a planet, moon, asteroid, etc., but never a star because we don't see stars move very quickly) goes in front of another celestial body. Usually, it is the moon or a planet that, in its motion, moves in front of a star. In the case of Jupiter, there are people who have regularly observed occultations that involve Jupiter.

Based on what I know about occultations (which isn't a whole lot), unless there is an atmosphere involved (which will be discussed in the next chapter), the light bends very little, if at all. This slight bend could be caused by the River Effect Laws (to be discussed below) or the Density of Ether Laws (to be discussed in the next chapter) or something else. Sorting all of this out will take a considerable amount of time, but for now it is sufficient to state that there are three possible causes of the key types of "aberration," and two of them involve the actual bending of light.

Occultations involving the mountains on the top or the bottom of the moon (from our perspective) can be measured extremely accurately. These occulations, called "grazes" when the starlight grazes the top or bottom of the moon (as it appears to us), indicate that the Moving Medium Laws are part of the answer to aberration.[30]

## Signals That Travels With a Particle Versus Signals Between Two Particles

Suppose there are 1,000 soldiers standing in a perfectly straight row (shoulder to shoulder), and they are standing 3 meters apart from each other. Now suppose there are a thousand rows of such soldiers, where there is 3 meters between rows. Now suppose all 1,000,000 soldiers start to march slowly across a large field in perfect formation.

As they are marching, a person tosses a ball to one of the soldiers on the outside column of the formation. This soldier instantaneously passes the ball to the soldier next to him, at the exact same speed that the soldiers are marching. In other words, the soldier only has the ball in his hands for a nanosecond, but throws the ball to the position of the solder next to him (in the same row) at the instant he received the ball. However, because the velocity of the ball is equal to the velocity of the marching soldiers, the ball would be caught by the soldier ***behind*** the solder standing next to him. In other words, while the ball is "in the air," the soldier standing next to him moves 3 meters forward, leaving his position vacant, and the soldier standing behind this solder moves into the vacant position of the soldier in front of him and catches the ball when it gets to him.

Now let us consider the person that originally threw the ball to the first soldier. As the ball is passed from soldier to soldier, during the march, the person that originally threw the ball would see the ball travel perpendicular to the direction the soldiers are marching. In other words, just like the person above the train in the previous example saw the water drop travel in a straight line, perpendicular to the road he is standing on, the person that threw the ball would see the ball travel in a straight line perpendicular to the vector of the marching soldiers.

Note that in this example, each soldier holds onto the ball for only one nanosecond, but the ball is passed to the next soldier (actually the person behind the next soldier), very slowly.

If we looked from above, and drew a line connecting all of the soldiers that touched the ball, this line would form a 45 degree angle relative to the vector of the marching soldiers, terminating at the soldier that first touched the ball. If we looked from above, and focused on the ball itself, it would move perpendicularly from the person that threw the ball.

Now let us change things.

Now let us suppose that each time a soldier receives the ball, he holds onto it while he marches for 3 meters, then he instantaneously (at the speed of light) passes it to the person standing next to him. In this case, the person marching next to him would be the one that catches the ball. Everyone that touches the ball would be in the same row.

If we looked from above in this case, and drew a line connecting all of the soldiers that touched the ball, this line would be one row of soldiers. However, the person that originally threw the ball would see the ball travel at a 45 degree angle to his right (assuming the soldiers were marching to his right).

In the first case, the ball was only instantaneously touching the soldiers, and slowly moved between the soldiers. In the second case, the ball was held on to by the soldiers, but was instantaneously passed to the person next to him. The pattern seen by those standing above the marching soldiers (i.e. a string connecting the soldiers that touched the ball) was different for the two cases. Likewise, it was different for the person that originally threw the ball.

If these soldiers represented ether particles, and if the ball represented an electromagnetic wave, which of the two examples best explains the moving ether drag as light enters the ether drag? The first case was the one already mentioned, which was represented by the chicken wire and train. In the first case, the chicken wire did not "carry" the drop of water with it, it simply "passed it on" instantaneously to the "next" wire that happened to touch it.

The second case will now be mentioned.

## The River Effect Laws (an Actual Bending)

The key element of the "River Effect" laws is the path of light entering the moving medium of ether drag, but in this case the assumptions are different. In this case, the light is carried with the ethons, and is instantaneously passed to the next ethon. The reader should pay close attention to any discussion of the "path" of sound in water. The term "River Effect" originates from a visualization of the path of sound in a river.

Let us for a moment consider a large, square swimming pool which is 10,000 feet across, side-to-side, and 100 feet deep. Let us put a bell, or some other device for making sounds, 50 feet below the surface in the middle of the swimming pool. Let us further put a device on two opposite sides of the pool (each halfway from the corners of the pool and across from each other), also 50 feet below the surface, which can not only detect sound intensities, but can also determine the direction the sound comes from.

If we ring the bell, based on the speed of sound in water, a certain amount of time will elapse between the ringing of the bell and when the listening devices on opposite sides can detect the sound. Let us measure this amount of time. This time is assumed to be the same time whether we were in a lake or a swimming pool.

Now let us change the scenario. Let us find a river which is 10,000 feet wide and which is 100 feet deep. Let us again put a bell 50 feet below the surface in the center of the river. Let us also put two listening devices, directly across from each other, such that the bell is half way between them (note: the bell and each listening device is 5,000 feet apart from each other). Each listening device is 50 feet below the surface. The line between the listening devices not only includes the bell, but is obviously perpendicular to the flow of the river. Further, let us assume that the water in this river travels from left to right, from the observer's perspective, at a speed of 150 miles per hour (a very fast river to be sure). The observer is standing next the bell on his side of the river.

Let us consider an imaginary circle around the bell, and consider that the shore is tangent to the circle (i.e. the radius of the circle is 5,000 feet). Since the bell is in the center of the circle, we can consider 360 different sound vectors leaving the bell, one for each degree of the circle.

One of these 360 sound vectors initially heads directly towards the bell at the opposite side of the river from the observer. While sound will reach this bell, the sound vector that ***initially*** heads towards this bell will not reach the listening device because the river will carry the sound downstream at 150 miles per hour. In other words, as the molecules of water bump each other, the water will simultaneously carry these molecules and the sound signal downstream. Since the water molecules physically bump each other, the scenario is somewhat similar to the second scenario with the marching soldiers, meaning the "time" the signal takes to travel between soldiers is virtually zero (because the molecules are bumping each other). After each molecule is bumped by a neighbor molecule, as it is traveling to bump the next molecule it is also traveling downstream.

Now consider the sound vector that actually did arrive at the listening device on the opposite shore. This sound vector initially headed upstream from the line perpendicular to the two listening devices. If a person could track the path of this sound vector, it would be seen that the path of this sound would travel in an arc, where the sound initially heads upstream from the listening device, then arcs and eventually heads downstream to where the listening device is located.

I have stated that sound travels in an arc in this situation; this statement needs to be clarified. Sound travels in water by water molecules bumping each other. Thus, if the water (i.e. the medium) is in motion, the water molecules are in

motion, and the motion of the water molecules will effect the path that the sound travels, since sound travels solely because of the water. Since the initial direction of this sound vector is upstream from the direction of the water, this sound vector will arc. Actually it will arc until its tangent becomes perpendicular to the motion of the water and then it will move in a straight line downstream (at the same angle the sound vector did that was initially headed towards the bell).

When a bell is rung, sound actually travels in all directions simultaneously. Thus literally 360 different paths of sound could be theoretically followed after one ringing of the bell. To plot the path of each of these 360 sound vectors would yield what I call the "River Effect Chart." It would be a combination of straight lines, curved lines, and lines that are at first curved and then go straight, as I will now expand on.

If a person could track the sound that initially heads in a straight line towards the listening device on the opposite side of the observer, that sound would travel in a straight line, but the straight line would head downstream from the listing device. This sound would not reach the listening device on the opposite side.

The sound vectors that initially head upstream and eventually reach the shore, however, do not travel in a straight line. The path of these sound vectors is an actual arc, regardless of where this sound reaches the other shore! This is because the sound is headed upstream originally, but the motion of the water carries it backwards as it travels. The arc may be very pronounced or be very flat, depending on:
1) The angle at which the vector heads upstream (i.e. the angle relative to a line which is perpendicular to the direction of the water), and
2) The relationship between the speed of sound and the speed of the water, and
3) The distance the sound has to travel.

Furthermore, for some of the upstream vector angles the arc may become a straight line before reaching the other shore. Once a line tangent to the arc becomes perpendicular to the direction of the flow of the river the sound vector will turn into a straight line from then on. Thus it may be an arc for only part of the time. However, the beginning point where it becomes a straight line is upstream from the direct line between the bell and listening devices.

Likewise, for some of the vectors that travel directly upstream, or nearly directly upstream (meaning nearly parallel with the flow of the water), these vectors will never reach the shore at all. They will theoretically come back, but will dissipate long before they come back to the bell, from where they came.

If this experiment were actually to be performed (actually such an experiment would be virtually impossible to perform unless a "sound laser" could be invented that shot out a very narrow sound wave), two things of significance would be learned.

First, for the sound vector that actually hits the listening device on the opposite side; the time that it takes the sound to reach the listening device will be longer than it took in the swimming pool (this is because of its path).

Secondly, for this same sound vector, the portion of the listening device which determines the direction the sound is coming from will falsely determine that the sound is coming from a point upstream from where the bell is actually located.

Now consider anyone standing on the far shore. If they could see the sound vector that initially heads for them, they would realize that this not the sound vector that arrives where they are standing.

It is of critical importance to note here that the medium is in motion. If the medium is stationary, and the bell is in motion, it is highly probable that all sound lines emanating from the bell will be straight lines. It is important to keep in mind whether it is the medium or it is the bell that is in motion**!** It is also important to keep in mind whether the measuring of the sound is taken by someone who is in motion in the water or who is standing on the shore.

With ether drag, if the River Effect Law solely causes aberration, it is an actual bending of light, and it occurs at the boundary of the moving ether drag.

**Back to Aberration**

Is aberration of starlight caused by the Moving Medium Laws or the River Effect Laws, or some combination of the two?

First, the reader should be reminded that the Moving Medium Laws create an ***apparent*** bending of light only to those ***inside*** of the ether drag. The River Effect Laws creates an ***actual*** bending of light, to everyone, whether inside the ether drag or not. Because occultations of Jupiter seem to indicate that starlight is not actually bent by a moving ether drag (or is bent very little), this experiment indicates that the Moving Medium Laws are the only laws, or are the dominant laws, affecting aberration. However, since no one has specifically looked at a Jupiter occultation with this question in mind, with extremely accurate measuring instruments and formulas, occultations cannot be considered a definitive proof of the Moving Medium Laws.

The point to this discussion is this, in the Moving Medium Laws the aberration of starlight would occur at the boundary of the ether drag. With the River Effect Law, if the starlight was headed downstream of the motion of our ether drag, the aberration of starlight would also occur at the boundary of the ether drag. To understand why, consider that when a sound vector comes from the bell, the angle of the vector is determined immediately after the bell is rung, not when the

vector is halfway to the opposites shore. With the River Effect Laws, if the starlight was headed upstream from the motion of our ether drag, the ratio of the speed of light and the velocity of our planet in orbit around the sun (remember the sun's ether drag is assumed to extend beyond our earth's orbit distance), is so dramatic, that it is unlikely that the light would arc significantly (i.e. it would be unmeasurable). Thus, even in this case the aberration of starlight would occur at the boundary of our ether drag. Thus, any aberration of starlight caused by the combination of the two laws would also be at the boundary of the ether drag.

## Sir George Airy Water-Telescope Experiment

Sir George Airy, in 1871, built a water-telescope to prove the ether theory. Because it was believed that aberration occurred inside the telescope (ether drag was known about, but was not generally believed at the time of his experiment), and because the speed of light is slower in water than in air, Airy expected that the aberration of light in a normal air-filled telescope would be different than the aberration of light in a water-filled telescope. In other words, refraction of light, when the starlight hit the boundary of the water in the telescope, would be different than normal aberration would predict. It did not happen - he got a null result, meaning the aberration of light was the same for both air-filled (as all telescopes are by default) and water-filled telescopes.

This null result is typically explained by ether proponents by using the Fizeau Drag Coefficient. However, the Fizeau Drag Coefficient is designed for use where there is ether, but no ether drag. During the time of the Airy experiment, ether drag had long been speculated, but it was not the commonly accepted theory for ether, as is evidenced by the surprise of the MMI null result.

In fact, what the Airy experiment proves is that the aberration of light occurs ***before*** the light gets to the telescope. Airy was looking at stars directly above him, thus the angle at which the light is coming in is so small that the refraction of this light as it hits the boundary of the air and water would be negligible. Nevertheless, a modern day Airy experiment, done with the telescope pointing straight up, as his was, and done with far more accuracy than the original, would be a good test for whether aberration of starlight in ether drag occurs at the boundary of the ether drag.

The concept of ether drag does not depend on the Moving Medium Laws or the River Effect Laws, but it is fairly apparent that stellar aberration does occur at the boundary of the ether drag.

It was also well known in the late 1800s that the Fizeau Drag Coefficient was not needed for terrestrial light sources.[6] This should have been a clue that ether drag was indeed the preferred theory of ether, but obviously it did not catch on at the time.

## Secular Aberration and Ether Drag

The above discussion explains the observable 30 kps stellar aberration of starlight. How about the 370 kps secular aberration of starlight?

If the sun's ether drag does not extend to the orbit distance of the earth around the sun, then the aberration that occurs at the edge of the earth's ether drag must be at the total 340 to 400 kps velocity of our earth in the cosmos. The differential aberration, caused exclusively by our orbit around the sun, would be observable, but the 370 kps of secular aberration would not be noticeable because it is constant.

However, it is much more likely that the suns ether drag extends far beyond the orbit of our earth around the sun. Consider this logical sequence:

1) The sun's ether drag extends far beyond the orbit of our earth, and
2) The sun's ether drag is moving at 370 kps in the cosmos towards Leo, and
3) When light from outside of our sun's ether drag hits this moving ether drag, by the Moving Medium Laws (and/or River Effect Laws) the light bends (apparent or actual) at the boundary of the ***sun's*** ether drag as a function of the speed of the sun's ether drag (i.e. 370 kps) (note that because we are inside of the sun's ether drag we see the light bending with either law), however,
4) Because of the almost linear motion of our solar system, starlight consistently bends in the same direction day after day and year after year and century after century,
5) In other words, the major bending of this light occurs many millions of miles away and has been bending in the same direction for many thousands of years, long before telescopes were invented and long before they were first calibrated, and
6) Because the sun is moving in such a straight line, and for a few other reasons, the same calibration of our telescope will work for a long time (i.e. we don't have to continually adjust our telescopes for this bending),
7) Only the bending of light that is due to the orbit speed of our earth around the sun (i.e. when the starlight hits our earth's ether drag), can be detected because it forces the constant recalibration of telescopes.

In other words, ether drag can easily explain account for the entire 340 to 400 kps variable velocity of our earth towards Leo.

For planets and the moon and other objects that are inside of our sun’s ether drag, their light travels within the sun’s ether drag and thus because we are also within the sun’s ether drag, our telescopes do not need to be tiled for secular aberration. For planets that are outside of the sun’s ether drag, the bending would occur many millions of miles away and the bend would be consistent (for a given location of the planet), thus celestial mechanics formulas would be

calibrated for their apparent location, which would include secular aberration (all of this ignores galactic ether drag). Because the pattern of ether drag in the galaxy is a matter of pure speculation I will not pursue this issue.

Thus, aberration of "starlight" for Mercury (assuming we knew where it actually was), would be different than aberration of "starlight" for Jupiter (assume we knew where it was and assuming the sun's ether drag did not extend that far).

## Comments

In 1923-1924, during the short ether-photon debate, it was believed that our earth's only motion in space was a closed elliptical orbit around the sun. Thus annual aberration of starlight, which was also based on a closed elliptical orbit, was considered proof of the photon theory of light.

But our earth's average speed is now known to be 370 kps and our net direction is nearly linear. But yet annual aberration of starlight is still based on an average speed of only 30 kps and the tilt of telescopes is still based on a closed elliptical orbit!

Indeed, even though all of this can be easily explained, when the discovery of CMBR was made, the ether-photon debate should have been reopened, but it wasn't.

# Chapter 15

# Atmospheric Refraction and Ether

"If the only tool you have is a hammer, you tend to see every problem as a nail."
Abraham Maslow

## The Speed of Light and Ether

The Hafele-Keating experiment demonstrates that the "density" of ether varies by altitude. Because ether is a medium for light, one might wonder whether the speed of light also varies by altitude. I believe it does, however, determining this using atomic clocks would be extremely tricky because the "time" measured by atomic clocks also varies by the density of ether and thus by altitude, thus a person would have to isolate whether the "speed of light" variation was due to a difference in the speed of light or a difference in the speed of the atomic clocks (i.e. a difference in the "time" registered by the atomic clocks at a higher altitude).

While it is well known that sound (a wave) travels faster through denser mediums, sound is a physical bumping, and light is an electromagnetic bumping, thus the properties of sound are not necessarily the properties of light.

Nevertheless, there are two experiments or phenomenon that do indicate that not only does the speed of light vary by altitude (i.e. density of ether), but that in the denser ether the speed of light is faster.

## Atmospheric Refraction

"***Atmospheric refraction***" is a type of aberration caused by the refraction of light as it passes through our atmosphere. It is most pronounced on the horizon, but is in affect everywhere except the zenith. It is generally believed that this type of aberration is caused by the air in the atmosphere refracting light (i.e. hence its name: "atmospheric" refraction). This is somewhat logical, but ether provides another answer.

If the speed of light is faster in a denser medium of ether (as would logically be expected), then as a light ray from the sun got closer to the earth, the speed of light would increase.

Let us represent one thin slice of a layer of ether density of ether drag by a thin, hollow sphere that surrounds the earth, with its center at the center of the earth,

and where the boundary of the sphere is 10,000 kilometers above the surface of the earth. Now let us consider that the light from the sun is 5 degrees above our horizon. When this ray of light hits the imaginary sphere that we have constructed in our minds, let us consider a 2D plane that is tangent to our imaginary sphere at the point where this ray of light hits the sphere. Now let us consider a vector that is normal to the tangental plane and passes through the center of the earth.

Snell's Law states that when a beam of light hits the boundary of two substances, which carry light at different speeds, and if the light is moving from the medium which offers a ***slower*** speed of light into the medium which offers the ***faster*** speed of light, the light will bend in a direction ***away from*** the normal vector. However, it is well known in astronomy that the light actually bends ***towards*** the normal vector.

This, of course, is exactly the opposite of what Snell's Law would predict if the speed of light is faster in denser ether. There are several ways to explain why the result is not what would be expected.

1) The speed of light is actually is slower in the denser medium.
2) Atmospheric refraction is actually caused by two factors, which have opposite effects, one being the atmosphere and the other being ether, with the atmospheric component being the more dominant of the two.
3) The speed of light is the same in all densities, and all of atmospheric refraction is caused by the atmosphere.

Personally, I don't like any of these explanations. However, there is one explanation I do like.

Let us consider Snell's Law with respect to air and water. Air and water are called "mediums" for light when discussing Snell's Law, as I did above. This is not true. Air and water are "***obstructions***" to light, not mediums for light. Only ether is a medium for light. Air and water are obstructions. Thus, Snell's Law basically states, that when light travels from one "***lesser obstruction***" (lower index of refraction) to one "***greater obstruction***" (higher index of refraction), the light will bend in the direction of the normal vector.

Ether, however, is the one and only true "***medium***" for light. Thus, we might have a modified Snell's Law for use where there is no significant obstruction, only pure medium involved: "When light travels from one "***lesser [dense] medium***" (i.e. slower light, viewed from the aspect of the true medium, not an obstruction) to one of "***greater [dense] medium***," the light will bend in the direction of the normal vector.

Since ether is a "***catalyst***" for light, not an obstruction, this make logical sense. The denser ether is the path of least resistance and the light would favor the path

of least resistance. This is especially true since the density differences are very gradual, not abrupt. Nevertheless, logic is not the determining factor.

"Logic is a system whereby one may go wrong with confidence."
Charles F. Kettering

I call the actual bending of light by different layers of ether drag density (***towards*** from the normal vector) the: "***Density of Medium Law***." Whether the Density of Medium Law exists or not will have to be determined by experiment at some time in the future.

## The Bending of the Light of Jupiter Occultations

If the Density of Medium Laws were true, wouldn't occultations of light near Jupiter bend the light of the stars significantly. Yes, but we would not see this bending from where we are. This is because the Density of Medium Laws would apply ***twice*** to the starlight that passes through Jupiter's ether drag. The first time it would bend light down towards Jupiter, as it does on the earth. However, our telescopes are not located on the surface of Jupiter. This means the light would have to exit the ether drag of Jupiter in order to get to us (I don't know if we are inside of Jupiter's ether drag, but probably not). This means the light would have to go from the denser ether near the surface of Jupiter to the less dense ether far from the surface of Jupiter. This light would bend in the ***opposite*** direction of the first bend, offsetting the first bend. Thus, we would not observe either bend because they offset each other.

In reality it is possible the light from Jupiter does bend very slightly, but certainly not what would be expected from a single bend due to the Density of Medium Laws. The second bend may not completely offset the first bend, if, for example: the core of Jupiter may not be perfectly spherical, or the River Effect Laws may play a part. I don't know.

## The Bending of Light That Passes Near the Sun

Another question that might arise is whether the bending of light that passes next to the sun is caused by the Density of Medium Law. First of all, I am not sure that anyone has proven that light that passes next to the sun does bend. The original experiment that claimed to detect this phenomenon was seriously flawed and only coincidentally came up with the "right" numbers to support Einstein. Nevertheless, assuming such is the case (due to far more modern experiments of a different nature), since the earth is probably inside of the sun's ether drag, it is possible that ether is what causes that phenomenon. Let me explain.

Unlike the case with Jupiter, where two bendings of light offset each other, because we are probably inside the sun's ether drag, we would see the light ***before*** it completely straightens out (by a second complete bending) after it has passed near the sun's surface. In other words, the light actually bends twice, but we see the light before the second bend completely offsets the first bend, thus the net of the two bends (one completed and one incomplete) is a slight bend. I do not necessarily claim this is the case, I simply mention that it might be the case and explain how it might be the case.

Since we have been talking about two bends, it might be emphasized that in the case of the earth's atmospheric refraction, the light bends the first time, but because the person or telescope is sitting on the surface of the earth, the first bending is observed before the second bend even begins.

## The Speed of Light From Jupiter:

There is an experiment that measures the speed of light in the solar system. In this case it is the measurement of the speed of light between Jupiter and the earth.

Imagine that there are three people looking at Jupiter. Each of them has a watch and all of their watches are synchronized. Person number one is stationary on the path of the orbit of our earth, at the point where our orbit is closest to Jupiter (at the instant the light leaves Jupiter). Person number three is stationary on the path of the orbit of earth, at the point where our orbit is furthest away from Jupiter (at the instant the light leaves Jupiter). Person number two is halfway between the other two, which would be near the sun or possibly even inside of the sun.

Now consider the moment of time that a specific moon of Jupiter goes into the shadow of Jupiter (or casts its shadow on Jupiter's surface). If light travels at an infinite velocity all three people will observe the shadow at exactly the same time. On the other hand, we know that if person #1 observes this phenomena at 1:00PM, that person #2 will observe it at about 1:08PM and that person #3 will observe it at about 1:16PM. These, of course, are approximations.

Knowing that the orbits of the moons of Jupiter are constant and predictable, scientists can measure the speed of light between Jupiter and the earth by writing down the time that the shadow of Jupiter starts to cover this specific moon (usually the moon Io) in its orbit. By calculating this time in many experiments, each relative to where the earth is in its orbit, very accurate measurements of the speed of light in our solar system can be determined.

Since the first of these experiments was done in 1676 by Romer, far better computer models of the solar system have been built, and far better approximations of the speed of light in our solar system have been calculated.

According to Ditchburn[29-page 301], the speed of light from Jupiter to the earth is 0.5% slower than the speed of light in a vacuum on the surface of the earth. On the surface, this observation is an indication that the speed of light is faster on the surface of the earth, than it is in space, meaning the speed of light is faster if the ether is denser. But it is not quite as simple as that. Consider the following problems in making such a simple assumption.

First, I do not know whether the 0.5% figure is accurate based on modern equipment and modern celestial mechanics formulas. When was this data collected? What figure would be arrived at today, using the best of astronomy and celestial mechanics? I do not know.

Second, it is obvious that the ***sun*** creates its own ether drag, but we don't know how far into the solar system its ether drag goes, thus we don't know the density of the sun's ether drag between our earth and Jupiter, compared to the density of ether on the surface of the earth, though the sun's ether drag between the Earth and Jupiter is probably less.

Third, ***Jupiter*** also creates its own massive ether drag, but we don't know how far into the solar system its ether drag goes (i.e. we don't know how close it gets to us), or how dense it is between the two planets.

Fourth, the density of the ether drag of both the sun and Jupiter, varies significantly according to the relative "altitude" from these objects. These figures are not available.

Fifth, it is not known whether the speed of light on the surface of Jupiter is faster or slower than the speed of light on the surface of the earth, all we know is the density of the ether will be greater on the surface of Jupiter.

Nevertheless, in spite of all of the criticisms, it is reasonable that the ***average*** density of ether between the surface of the earth and the surface of Jupiter, is less than the density of ether on the surface of the earth. Thus it is logical to say that the less the density of ether is, the slower is the speed of light, if the experiment is verified.

## Comments

There has been a considerable amount of speculation in this chapter and the prior chapter. Most of the speculation is caused by experimenters not looking for what I want them to look for, thus the data that I need does not exist in a form I can use. The most important thing to remember from these two chapters is that aberration of starlight undoubtedly occurs at the boundary of our ether drag. ***Considering my two experiments on the path of light, it is absolutely impossible that aberration occurs inside of the earth's ether drag, meaning***

***inside of the telescope.*** Aberration must occur long before the light gets to the telescope.

# Chapter 16

# The De Witte Effect

"If we ignore the facts contained in one part of the world, surely we are hampering scientific advance."
Sir Douglas Mawson (1882-1958)

## Introduction

As has been stated many times in this text, our solar system, and thus our earth, is moving at about 370 kilometers per **second** (kps), relative to cosmic microwave background radiation (i.e. CMBR).

One of the main purposes of the SR is to dispense with the concept of a URF and to replace it with the concept of a RRF. In other words, according to Einstein, the motion of our earth in space has no affect on anything that happens on earth, because the Universe itself is not a reference frame. This theory has already been disproven with the discovery of the CMBR. However, there is another experiment that more directly detects this URF - the Roland De Witte experiment of 1991.

During a 178-day experiment in Belgium in 1991, Roland De Witte detected a phase shift in the frequency of a 5 Mz signal sent 1.5 kilometers on a copper coaxial cable. But what was of profound significance about the observed shifts is that the phase shifts changed constantly and formed a sinusoidal curve with a nearly perfect "***sidereal day***" period for the entire 178-day duration of the experiment**!**[19]

A "sidereal day" period can only be attributed to the motion of the earth relative to the Universe. In other words, De Witte detected a URF; something that Einstein said did not exist**!** Neither Einstein's SR, nor his GR, would ever predict an experiment with a sidereal day period.

As to why De Witte detected this sinusoidal period may be up for discussion, but the mere fact he detected such a period is indisputable proof that there is a URF. His data (ignoring his theories) is sufficient to prove that**!**

This chapter is designed to help people understand the De Witte experiment. The most common explanations I hear for why he got uniform phase shift patterns involve: ground temperature, the magnetic field of the earth, or other solar activity related items. Such explanations reflect a total misunderstanding

as to what a "sidereal day" is. Anything related directly or indirectly to the orbit of our earth around the sun will generate data that synchronizes with a "calendar day," ***not*** a "sidereal day." A sidereal day is an entirely different phenomenon than a calendar day (i.e. solar day), as I will explain below.

The end result is that the De Witte experiment is one of the great experiments of the twentieth century and deserves to be replicated and understood by everyone.

## Overview of the De Witte Experiment

During 1991, while at the Belgium Telephone Company (now Belgacom), Roland De Witte set up an experiment using 1.5-kilometer copper wires, six cesium atomic clocks and six phase comparators. A phase comparator gives a DC signal proportional to the phase difference variation between two signals. This DC signal was recorded 24 hours a day, during the 178-day experiment.

Three atomic clocks were set up at point A and three at point B, where A and B were both in Brussels. Point A and point B were 1.5-km apart (Note: generally the cable was north/south, but it was not straight). Two key signals traveled over separate underground coaxial cables. The signals from A1 towards B1 and from B1 towards A1 demonstrated a clear sinusoidal waveform (per the phase comparators) with a consistent sidereal day period for the entire experiment. The other clocks were used to establish a baseline.

## The Definition of a Sidereal Day

A "sidereal day" is 23 hours and 56 minutes (and 4.09 seconds), as opposed to a "calendar day," which is exactly 24 hours. Our clocks are ***defined*** and calibrated to specifically measure one revolution of the earth relative to the location of our sun. That is the calendar day. In other words, as the earth orbits the sun, a calendar day is the rotation of the earth defined such that in 24 hours the same spot on the earth is again directly under the sun.

But a "sidereal day" is an entirely different matter. A sidereal day measures one revolution of the earth relative to some distant object, such as a distant star. A sidereal day has absolutely nothing to do with the rotation of the earth relative to our sun, but is based on the rotation of the earth relative to a very distant point in outer space, the further the better.

(Note: As usual, my discussions on astronomy are simplified so the reader can focus on the important concepts and not get distracted with issues not directly significant to the discussion. A "sidereal day" is technically defined as: "the length of time for the vernal equinox to return to your celestial meridian." See: http://csep10.phys.utk.edu/astr161/lect/time/timekeeping.html

However, such a definition is neither intuitive nor instructive, nor is it any more accurate than my definition.)

To understand the difference between a sidereal day and a calendar or solar day, do this exercise. Pick a spot on your desk or table. Practice moving a pen or pencil in a large circle around the spot on your desk or table. The pen represents the earth. The spot on your desk represents the sun. The pen circling around the spot represents the orbit of the earth around the sun. Each circle represents one calendar year.

Actually the pen represents a line drawn through the center of the earth, from equator to equator. The point of the pen always represents the same point on the earth, which is on the equator.

Now orient the pen in two different ways. First, as you move the pen around the spot, make sure that the point of the pen always points to the spot. As the earth orbits the sun, after each 24-hour period the same spot on the earth (i.e. the point of the pen), points to the sun (i.e. the spot on the desk). If you were to twirl the pen around its center about 365 times as the pen makes one circle around the spot, you would have 365 calendar days. **Each time the point of the rotating pen points to the spot on the desk is another calendar day.**

Now let's do this a second way. This time pick a corner of a window pane, or the corner of something else, in your room, as far away as possible from your desk. Now as you circle the pen around the spot, make sure that the point of the pen always points to the corner of the window. Without twirling the pen, note that the point of the pen only points to the spot on the desk one time as it circles the spot. If you were to twirl the pen around its center about 365 times as the pen makes one circle around the spot, you would have 365 sidereal days. **But in this case the beginning of the sidereal day is when the point of the pen is aimed at the corner of the window.**

Thus, as you quickly twirl the pen around as it slowly circles the spot, whenever it points to the spot on the desk is the beginning of a new calendar day, but whenever it points to the corner of the window is the beginning of a new sidereal day. Study this for an entire circle of the sun and note how the calendar day and the sidereal day become totally unsynchronized with each other as you circle the spot.

Finally, do one last key demonstration. Position the pen and start the experiment so that a line drawn through the long axis of the pen points to ***both*** the spot on the desk and the corner of the window. Now, ***without*** twirling the pen, keep the pen pointed towards the windowpane and move the pen in a half-circle until it is on the exact opposite side of the where you started. With the pen pointed towards the corner of the window, slowly spin the pen until it points to the spot on the desk. Estimate how many calendar day "hours" (360 degrees equals 24

hours) it will take for the point of the pen to rotate until it points to the spot on the desk.

The correct answer is 12 hours. Over a period of half a year, a sidereal day and a calendar day drift about 12 hours apart**!** Over a period of 178 days, the length of the De Witte experiment, it is quite easy to determine whether the sinusoidal period of his data had a calendar day period or a sidereal day period.

So why is there a difference? From an astronomy perspective, there is no need to have a calendar day, it makes no sense. But people who go to work at 8:00 AM every morning, want to go to work in the morning all year long. They don't want to go to work at 8:00 AM in the middle of the night, as would happen sometimes if we used a sidereal day for our clocks.

Since the earth orbits the sun, it is convenient for people to measure time relative to the sun. The sundial was obviously oriented towards a calendar day. Thus the calendar day was adopted over the more correct sidereal day. Thus, on average, the sun will reach its pinnacle at about noon (per our clocks) on every day (as I said this is a simplification), anywhere in the world and on any day.

## Theoretical and Actual Data

Let's look at a table showing how these two concepts become unsynchronized using theoretical data.

**Column 1:** The day number of the experiment, using standard calendar days. Note that on the chart 9 days are skipped between each row to better show the difference between a calendar day and a sidereal day.
**Column 2:** The calendar time, noon in this example, for the days shown. This is what our watch would read as each new **calendar day** begins (at noon in this case).
**Column 3:** The calendar clock reading when the sidereal day starts. In other words, if we look at our standard calendar watch continuously, this is the **approximate** time that the referenced **sidereal day** begins.

| (1) | (2) | (3) |
|---|---|---|
| 1 | 12:00 | 12:00 |
| 11 | 12:00 | 11:20 |
| 21 | 12:00 | 10:40 |
| 31 | 12:00 | 10:00 |
| 41 | 12:00 | 9:20 |
| 51 | 12:00 | 8:40 |
| 61 | 12:00 | 8:00 |
| 71 | 12:00 | 7:20 |
| 81 | 12:00 | 6:40 |
| ... | | |

As can be seen, in less than three months the sidereal day begins more than 5 hours before the calendar day**!** By the end of a 178-day experiment the sidereal day and calendar day are about 12 hours off. In the actual experiment, a regression line drawn through the actual data was consistently very close to the theoretical sidereal day.

This is why temperature, solar activity, humidity, etc. cannot cause a sidereal day period. Temperature changes are synchronized with the calendar day (because the sun affects temperature). But the De Witte experiment was synchronized with the sidereal day**!**

From the standpoint of the De Witte experiment, the fact that his data had a sidereal day period is of ***profound*** significance, because it means his data is related to the universe, rather than to the sun**!**

Here is actual data from the De Witte experiment.

The first zero crossing time (i.e. the time where there was no phase shift) occurred on 3 June 1991 at 7h19 GMT or 22h20 Greenwich ***Sidereal*** Time. The measurements below represent zero crossing times compared to a sidereal day period; beginning with the first zero crossing time.

| | |
|---|---|
| 4 june 1991 | +15m |
| 11 june | +20m |
| 18 june | +35m |
| 25 june | +15m |
| 2 july 1991 | -5m |
| 9 july | -10m |
| 16 july | -15m |
| 23 july | -5m |
| 30 july | +15m |
| 6 august 1991 | +15m |
| 13 august | +20m |

```
20 august          +10
27 august          +25m
3  september 1991  +20m
10 september       +25m
17 september       +15m
24 september        0m
1  october 1991    -10m
8  october         -5m
15 october         +10m
22 october         +25m
29 october         +15m
5  november 1991   +20m
12 november        +30m
19 november        +10m
26 november        +18m
```

By studying the regression line for this data (see his web site), the obvious answer is that his data represents a perfect sidereal day period, but there is minor noise.

Considering the number of variables during the experiment related to calendar days (e.g. temperature), some noise is to be expected, but the core of the data (i.e. the regression line) is clearly sidereal in nature**!**

It is currently not know why the De Witte Effect exists. I will discuss several possibilities for why his data resulted.

## Doppler Effect

Let us consider a train that is headed down a perfectly straight train track at 150 kph. The train headed down the train tracks represents the earth's net motion in space.

On the front engine of the train, suppose there is a very loud horn pointed straight ahead, as they always do. The horn represents the 5 Mz signal sent down the copper wire. The sound waves will clearly be compressed to those people in front of the train.

Now let us rotate the horn as the train travels, and measure the sound wave compression, or expansion, from a point 100 feet directly in front of the direction the horn is pointed. For example, we could rotate the horn 15 degrees to the left of the tracks and measure the sound waves (frequency) 100 feet from the horn, in the exact direction the horn is pointed (i.e. ***not*** in the direction the train is headed).

Now suppose we measure the frequency of the signal every 15 degrees until the horn has made a complete rotation (that is 24 measurements in total).

If we plotted these 24 measurements on a graph, and then plotted a 25th measurement when the horn is again pointed straight ahead, we would notice a somewhat sinusoidal plot.

So what is it that represents the rotation of the horn? It is the rotation of the earth.

Just like a train headed down straight tracks, the earth is moving in a straight line in the direction of the constellation Leo. The rotation of the earth is equivalent to rotating the horn of a train, though things are a lot more complicated with the earth.

Now let us suppose that the train tracks were straight for many thousands of miles, and suppose we rotated the horn of the train continuously and smoothly so that it made one exact rotation once every ***sidereal day***. If we plotted the frequency of the horn signal, we would see a sinusoidal wave (under perfect conditions) with a period of exactly one sidereal day.

If someone else came along, and didn't know anything about the speed with which the horn was rotating, he or she could look at the graph and conclude that the horn rotated once every sidereal day. The person could also determine the speed of the train by looking at the graph.

Likewise, we can look at the De Witte data, and conclude that the earth is rotating once every sidereal day. Even though we already knew this, it is earthshaking news that electrical signals are affected by something that is related to our motion towards Leo**!**

So where and why could the Doppler Effect happen? It must happen as the electrical signal is originally created. Because of ether drag, even though ether is needed for the electrical signal, the ether itself cannot have caused the Doppler Effect. If the Doppler Effect is the correct explanation, there must be something related to the universe (it cannot be our solar system or else he would have got a calendar day period) that ether drag does not filter out. What that might be I do not know.

## The Moving Target Laws

Understanding this explanation requires a strong understanding of the Moving Target Laws **(MTLs)**, which have been discussed in detail in an earlier chapter.

Suppose there is a train traveling at 100 miles per hour forever on a train track that loops the earth at the equator, meaning the train is traveling in a permanent loop around the equator of the earth. Suppose that on this train there are three flatbed cars. In the middle of the middle flatbed car there is an archer. On the car just in front of the archer's car there is a target 100 feet from the archer. Likewise, on the car just behind the archer's car there is a target 100 feet away.

Now let us suppose that the archer shoots his arrow at such a speed that in the time it takes the arrow to travel 100 feet the train moves 50 feet (obviously wind, momentum and a lot of other things are ignored to make this example simple). Relative to the **train**, if the archer shoots an arrow at the forward car, the arrow will travel 100 feet. But relative to the **train tracks** (meaning the air space or the ground), the arrow will travel about 150 feet (simplified).

In other words, if we marked a spot on the tracks **below the archer** at the exact moment the arrow was released; and then if we marked a spot on the tracks **below the target** at the exact moment the arrow hits the target, these two marks on the tracks would be about 150 feet apart. I call this the "***virtual distance***" the arrow travels.

Relative to the train, if the archer shoots an arrow at the car behind the archer, the arrow will travel 100 feet. But relative to the train tracks, the arrow shot to the rear car only travels about 50 feet (ditto yielding marks about 50 feet apart on the tracks).

Now a simple question: is the "time" it takes the arrow to travel to each target a function of the distance traveled by the arrow relative to the "train" or relative to the "train tracks?" Obviously, relative to the train tracks**!** Ponder that very carefully - "time" is measured relative to the ground, meaning the "virtual distance"**!**

Now suppose the archer is born on the train in a large covered boxcar and knows nothing about the train tracks or the ground, meaning he only knows about the box car he lives in. In other words, the boxcar is as big as the three flatbed cars in the prior example. Note that the traveler cannot see the ground near the train, nor can he see the sky. To a person born on the train, who can only see the box car, the box car is not moving because everything on the train has the same momentum. Thus the archer would grow up thinking that the box car is stationary and the box car is the only reference frame.

Now suppose the archer measures the ***time*** that it takes the arrow to travel to the forward car and suppose he measures the ***time*** that it takes the arrow to travel to the car behind the archer. He notes that both arrows have traveled 100 feet relative to the train, but he also notes that it took a different amount of time for each arrow to travel to their respective target. This would certainly puzzle the archer if he knew nothing about the train tracks.

However, eventually he would conclude that the train he lives on is not the only reference frame and that there must be a **"*second*"** reference frame other than the train**!**

Now suppose the entire boxcar frame slowly rotates completely during each sidereal day. In this case, the time he measures, if he shot the arrow every few minutes, would form a sinusoidal pattern with a sidereal day period.

That is basically what De Witte has done, he had detected a "second" reference frame that the earth is subject to (other than the earth itself). When the "velocity" of the earth has an affect on phase shifts in copper wires, there is clearly something significant going on. When the phase shift pattern follows a sidereal day period for 178 straight days, whatever is going on is related to the motion of the earth in open space.

Let us assume that the cable was pointed directly in the direction the earth is moving towards Leo. In the time that it takes the electrical signal to travel 1,500 meters, the earth moves about 1.5 meters (Note: the earth moves at slightly above 1/1,000th the speed of light). This means that the signal actually has to travel 1,501.5 meters to arrive at point B. This the "virtual distance," relative to CMBR, the signal has to travel.

Why could this affect the frequency of the signal? In essence, the signal is "stretched" out because of the Moving Target Laws at the atomic level. In other words, if a signal leaves point A, and by the time the signal gets to point B, point B is 1,501.5 meters away, the signal has to travel 1,501.5 meters to get to point B.

The point is that this "stretching" out (or "shrinking" 12 hours later) of the signal, at the atomic level, could very easily change the frequency of the signal. It fact it ***must*** change the frequency of the signal. What is not known, however, is how much the MTLs contribute to the overall sinusoidal wave.

Another possibility is that it is the constant ***change*** in the distance (between two consecutive measurements) the signal has to travel that causes the frequency change.

In fact, it is illogical to think that either the Doppler Effect or the MTLs could affect the frequency of electrical signals. But something causes the frequency of the signal to change**!** Data is data, even if it can't be explained.

## The Cavity of the Copper Cable

Another possibility that is directly related to the MTLs is that the change in frequency is related to the copper wire itself. An electrical signal "bounces" around inside of a copper wire. This means that the outside surface of the copper wire essentially forms a "cavity," much like the cavity in the Blackbody Radiation experiment or the cavity inside of a fiber cable.

As the earth rotates, because of the MTLs and the motion of the earth towards Leo, the "pattern" of bouncing around constantly changes. For example, if the wire happened to be straight (which is wasn't), and the wire happened to be pointed directly at Leo, the center of the signal would barely "bounce" off of the sides. On the other hand, if the wire happened to be straight, which is wasn't, and was pointed perpendicular to our path towards Leo, the center of the signal would have been bouncing around quite a bit. This extra bouncing could very easily have changed the frequency of the signal.

A couple of subtle comments De Witte makes on his web lead me to favor this theory.

## A Second Kind of Ether

De Witte, himself, believed he detected the ether. While it is true that without ether there would be no electricity, his opinion is in direct contradiction with my experiments, which have detected ether drag. Because the ether drag affects the surface of the earth, the only difference in the speed or frequency of light or electricity inside of the ether drag would have been related to the rotation velocity of the earth in Belgium (not the motion of the earth towards Leo). This is clearly not what De Witte detected. In fact, because his copper wire was buried in the ground, he would not have detected any type of change in the velocity of the electricity, due to the rotation of the earth, because the rotation speed of the earth would be constant (between the two endpoints of the cable).

Personally, I feel it is possible that there is a second type of ether, but I highly doubt that De Witte detected this type of ether, if it exists. The normal ether that this book has talked about transmits an electromagnetic signal. The De Witte Effect only deals with an electrical signal in a copper wire. It is doubtful that an electrical signal would be affected by a second kind of ether in an entirely different way than the magnetic portion of the signal would be affected by the main type of ether. This would mean that the electrical and magnetic portions of electromagnetic signals would always be out of phase with each other. This is not likely and has not been observed to my knowledge. In fact, Telsa claimed that electrical signals, by themselves, could be transmitted through the ether this book talks about.

In any case, because his electrical signal was passing through a copper wire, not the air, it is possible that the electrical signal could have been bound to the copper atoms and the issue of electromagnetic signals would be moot. Nevertheless, it is highly unlikely that a second kind of ether would deal with electricity in copper wires and the first kind of ether would deal with electrical signals in the air.

However, there is a slim possibility that there is a second kind of ether that is not subject to ether drag. This kind of ether would have to be unrelated to light or other electromagnetic signals or electrical signals. Nevertheless, it could have an effect on the physical equipment that generated the signal (see the Doppler Effect discussion). But even this is unlikely because if the second type of ether could effect the De Witte experiment, it probably would have affected the H-K atomic clocks.

## The De Witte Experiment Needs to be Replicated and Improved

The reader might remember my lecture on keeping theories and data separate. The data of the De Witte experiment cannot be challenged in terms of it having a sidereal day period. Someone may disagree with my analysis and Roland's analysis, but the data cannot be disagreed with.

The De Witte experiment is one of the great experiments of the twentieth century. He deserves credit for his experiment. But perhaps just as importantly, his experiment needs to be redone, with several changes.

First, the copper wires should only be about 300 feet long (I don't know if there were any repeaters along his wire) and each should be "as straight as an arrow." It is very disconcerting to me that the wire he used was not straight.

Second, a fiber optic cable should be placed next to the copper wire, obviously parallel to the copper cable. This would allow a comparison of an electrical signal and an electromagnetic optical signal side-by-side. I have often said that I thought that "wander and jitter" in fiber optic signals was caused by our earth's motion in space. I came to this conclusion before I learned about the existence of ether drag or De Witte's experiment. But even with ether drag the De Witte experiment leads me to believe the De Witte Effect also has an affect on fiber optic signals, particularly if the MTLs are involved.

Third, very accurate celestial mechanics formulas need to be derived and synchronized with the exact direction the copper and fiber optic wires are pointed. In fact, this experiment should be done several times, with the wires and fiber pointed in different directions each time.

The end result is that we can determine the real value of the De Witte experiment, and probably the real cause. Personally, I believe the De Witte Effect can lead to some major discoveries in physics**!**

# Chapter 17

# An Article on Tesla

"When a true genius appears in the world you may know him by this sign; that all the dunces are in confederacy against him."
Jonathan Swift

## An Article on Tesla By Steve Silverman

This article was taken from the web site:
http://members.tripod.com/~earthdude1/tesla/tesla.html

Here's a task for you to try:
Go check your encyclopedia to find the answers to the following questions:
(answers are given in parentheses)

1) Who invented the radio? (Marconi)

2) Who discovered X-rays? (Roentgen)

3) Who invented the vacuum tube amplifier? (de Forest)

In fact, while you're at it, check to see who discovered the fluorescent bulb, neon lights, speedometer, the automobile ignition system, and the basics behind radar, electron microscope, and the microwave oven.

Chances are that you will see little mention of a guy named Nikola Tesla, the most famous scientist in the world at the turn of the century.

In fact, few people today have ever heard of the guy. Good old Tommy Edison made sure of that.

After all, Tesla was considered an eccentric who talked of death rays that could destroy 10,000 airplanes at a distance of 250 miles, claimed to be able split the Earth in two, believed that both voice and image could be transmitted through the air (in the late 1800's), and essentially told Edison to take his DC electrical system and stick it you know where.

In other words, anyone that has even heard of Tesla probably considers him to be a first class wacko.

But, the times are a changin'.

The problem is that Tesla probably could do all these things that he claimed were possible. In fact, Tesla invented every single one of the items listed above (but gets no credit) and much more. Look around you and chances are Tesla is somehow responsible for most of the things that make modern life so modern.

No doubt about it, Nikola Tesla is the greatest mind since da Vinci.

So who is this genius?

Little Nicky Tesla was born in Smijlan, Croatia way back in 1856. He had an extraordinary memory and spoke six languages. He spent four years at the Polytechnic Institute at Gratz studying math, physics, and mechanics.

What made Tesla great, however, was his amazing understanding of electricity. Remember that this was a time when electricity was still in its infancy. The light bulb hadn't even been invented yet.

When Tesla first came to the United States in 1884, he worked for Thomas Edison. Edison had just patented the light bulb, so he needed a system to distribute electricity.

Edison had all sorts of problems with his DC system of electricity. He promised Tesla big bucks in bonuses if he could get the bugs out of the system. Tesla ended up saving Edison over $100,000 (millions of $$$ by today's standards), but Edison refused to live up to his end of the bargain.

Tesla quit and Edison spent the rest of his life trying to squash Tesla's genius (and the main reason Tesla is unknown today).

Tesla devised a better system for electrical transmission - the AC (alternating current) system that we use in our homes today. AC offered great advantages over the DC system. By using Tesla's newly developed transformers, AC voltages could be stepped up and transmitted over long distances through thin wires. DC could not (requiring a large power plant every square mile while transmitting through very thick cables).

Of course, a system of transmission would be incomplete without devices to run on them. So, he invented the motors that are used in every appliance in your house. This was no simple achievement - scientists of the late 1800's were convinced that no motor could be devised for an alternating current system, making the use of AC a waste of time. After all, if the current reverses direction 60 times a second, the motor will rock back and forth and never get anywhere. Tesla solved this problem easily and proved everyone wrong.

He was using fluorescent bulbs in his lab some forty years before industry "invented" them. At World's Fairs and similar exhibitions, he took glass tubes and molded them into the shapes of famous scientists' names - the first neon signs that we see all around us today. I almost forgot - Tesla designed the world's first hydroelectric plant, located in Niagara Falls. He also patented the first speedometer for cars.

Word began to spread about his AC system and it eventually reached the ears of one George Westinghouse.

Tesla signed a contract with Westinghouse under which he would receive $2.50 for each kilowatt of AC electricity sold.

Suddenly, Tesla had the cash to start conducting all the experiments he ever dreamed of.

But Edison had too much money invested in his DC system, so Tommy did his best to discredit Tesla around every turn. Edison constantly tried to show that AC electricity was far more dangerous than his DC power.

Tesla counteracted by staging his own marketing campaign. At the 1893 World Exposition in Chicago (attended by 21 million people), he demonstrated how safe AC electricity was by passing high frequency AC power through his body to power light bulbs. He then was able to shoot large lightning bolts from his Tesla coils to the crowd without harm. Nice trick!

When the royalties owed to Tesla started to exceed $1 million, Westinghouse ran into financial trouble. Tesla realized that if his contract remained in effect, Westinghouse would be out of business and he had no desire to deal with the creditors. His dream was to have cheap AC electric available to all people. Tesla took his contract and ripped it up! Instead of becoming the world's first billionaire, he was paid $216,600 outright for his patents.

In 1898, he demonstrated to the world the first remote controlled model boat at Madison Square Garden. So you can thank Tesla for the invention of those remote controlled planes, cars, and boats (and televisions!), also.

Tesla had a dream of providing free energy to the world. In 1900, backed by $150,000 from financier J.P. Morgan, Tesla began construction of his so called "Wireless Broadcasting System" tower on Long Island, New York. This broadcasting tower was intended to link the world's telephone and telegraph services, as well as transmit pictures, stock reports, and weather information worldwide. Unfortunately, Morgan cut funding when he realized that it meant FREE energy for the world.

Many stories claim that the U. S. government destroyed the tower during World War One for fear that the German u-boat spies would use the tower as a landmark to navigate by. In reality, Tesla ran into financial trouble after Morgan cut funding for the project and the tower was sold for scrap to pay off creditors.

The world thought he was nuts - after all, transmission of voice, picture, and electricity was unheard of at this time.

What they didn't know was that Tesla had already demonstrated the principles behind radio nearly ten years before Marconi's supposed invention. In fact, in 1943 (the year Tesla died), the Supreme Court ruled that Marconi's patents were invalid due to Tesla's previous descriptions. Still, most references do not credit Tesla with the invention of radio. (Side note: Marconi's radio did not transmit voices - it transmitted a signal - something Tesla had demonstrated years before.)

At this point, the press started to exaggerate Tesla's claims.

Tesla reported that he had received radio signals from Mars and Venus. Today we know that he was actually receiving the signals from distant stars, but too little was known about the universe at that time. Instead, the press had a field day with his "outrageous" claims.

In his Manhattan lab, Tesla made the earth into an electric tuning fork. He managed to get a steam-driven oscillator to vibrate at the same frequency as the ground beneath him (like Ella Fitzgerald breaking the glass with her voice in those old Memorex commercials).

The result? An earthquake on all the surrounding city blocks. The buildings trembled, the windows broke, and the plaster fell off the walls.

Tesla contended that, in theory, the same principle could be used to destroy the Empire State Building or even possibly split the Earth in two. Tesla had accurately determined the resonant frequencies of the Earth almost 60 years before science could confirm his results.

Don't think he didn't attempt something like splitting the Earth open (well, sort of).

In his Colorado Springs lab in 1899, he sent waves of energy all the way through the Earth, causing them to bounce back to the source (providing the theory for today's accurate earthquake seismic stations). When the waves came back, he added more electricity to it.

The result? The largest man-made lightning bolt ever recorded - 130 feet! - a world's record still unbroken!

The accompanying thunder was heard 22 miles away. The entire meadow surrounding his lab had a strange blue glow, similar to that of St. Elmo's Fire.

But, this was only a warm-up for his real experiment! Unfortunately, he blew out the local power plant's equipment and he was never able to repeat the experiment.

At the beginning of World War I, the government desperately searched for a way to detect German submarines. The government put Thomas Edison in charge of the search for a good method. Tesla proposed the use of energy waves - what we know today as radar - to detect these ships. Edison rejected Tesla's idea as ludicrous and the world had to wait another 25 years until it was invented.

His reward for a lifetime of creativity? The prized (to everyone but Tesla) Edison Medal! A real slap in the face after all the verbal abuse Tesla took from Edison.

The stories go on and on.

Industry's attempt (obviously very successful) to purge him from the scientific literature had driven him into exile for nearly twenty years. Lacking capital, he was forced to place his untested theories into countless notebooks.

The man who invented the modern world died nearly penniless at age 86 on January 7, 1943. More than two thousand people attended his funeral.

In his lifetime, Tesla received over 800 different patents. He probably would have exceeded Edison's record number if he wasn't always broke - he could afford very few patent applications during the last thirty years of his life.

Unlike Edison, Tesla was an original thinker whose ideas typically had no precedent in science. Unfortunately, the world does not financially reward people of Tesla's originality. We only award those that take these concepts and turn them into a refined, useful product.

Scientists today continue to scour through his notes. Many of his far flung theories are just now being proven by our top scientists. For example, the Tesla bladeless disk turbine engine that he designed, when coupled with modern materials, is proving to be among the most efficient motors ever designed. His 1901 patented experiments with cryogenic liquids and electricity provide the foundation for modern superconductors. He talked about experiments that suggested particles with fractional charges of an electron - something that scientists in 1977 finally discovered - quarks!

Wow!

Maybe history will finally recognize a true genius when it sees one.

[Kehr Note: As the author correctly states - what he mentions is just the beginning of what Tesla did. I just found out the other day, for example, that the best way to make ozone, for medical purposes, even today, is to use a device that Tesla invented.]

# References

"The only thing we learn from history is that we learn nothing from history."
Friedrich Hegel

This is an article and 2 books that talk about our total velocity in space:
[1] R. A. Muller, "The Cosmic Background Radiation and the New Aether Drift," Scientific American, Volume 238, No. 5, pages 64-74 (May, 1978). This article has a truly amazing graphic on page 65. This is an old article that estimates our net speed in the universe at 400 kps.
[2] Eric Chaisson and Steve McMillan, Astronomy Today, 2nd edition, Prentice Hall, page 582. This is an old book that also estimates our speed in the universe at 400 kps.
[3] William J. Kaufmann, III (deceased) and Roger A. Freedman, Universe, 5th edition, W. H. Freeman and Company, page 707. In the 4th edition, page 533, the speed of our solar system is estimated to be 390 kps, but in the 5th edition it is pegged at 370 kps. I use the latest figure of 370 kps in this book.

[4] U.S. Naval Observatory, Multiyear Interactive Computer Almanac 1990-2005, Willmann-Bell, Inc., page 119.

[5] One of the interferometer experiments, an interferometer by Silvertooth, claimed to detect our total motion in space. However, it is highly doubtful that the data of the Silvertooth experiment is credible. Attempts to duplicate his data using his techniques have failed, and the author's own experiments totally contradict both his data and his conclusions. His data also contradicts the results of numerous other interferometers. I would not mention his experiment if it had not been published in Speculations in Science and Technology, Volume 10, Number 1, 1987, page 3ff

[6] Janssen, Michael, Einstein for Everyone, "19th Century Ether Theory." I do not know if this has been published. According to Janssen, Augustin-Louis Cauchy was the first to propose "ether drag" in 1831, but George Gabriel Stokes became the champion of the ether drag theory as early as 1845 (pages 2-3).

[7] Howard C. Hayden, Cynthia K. Whitney, "If Sagnac and Michelson-Gale, Why Not Michelson-Morley?" Galilean Electrodynamics, Nov/Dec 1990, page 71ff. To see a copy of the original paper Michelson-Gale and Pearson wrote, it is reproduced (along with several other papers) in the book: A New Physics, by William Day, Foundation For New Directions, 93 Belmont St., Cambridge, MA 02138 (www.fnd.org)

These are the 4 key papers by Hafele or Hafele and Keating:
[8] Hafele, J. C., "Relativistic Behaviour of Moving Terrestrial Clocks," Nature, Volume 227, July 18, 1970, pages 270-271.
[9] Hafele, J. C., "Relativistic Time for Terrestrial Circumnavigations," American Journal of Physics, Volume 40, January 1972, pages 81-85.
[10] Hafele, J. C. and Keating, Richard E., "Around-the-World Atomic Clocks: Predicted Relativistic Time Gains," Science, Volume 177, July 14, 1972, pages 166-168.
[11] Hafele, J. C. and Keating, Richard E., "Around-the-World Atomic Clocks: Observed Relativistic Time Gains," Science, Volume 177, July 14, 1972, pages 168-170.

[12] Einstein, Albert, Relativity, The Special and General Theory, Crown Publishers, Inc., 1961, see Chapter XXIII, which was originally written in 1920 (see comments on pages 129 and 131)

[13] Ives, Herbert E. and Stilwell, G. R., "An Experimental Study of the Rate of a Moving Atomic Clock," Journal of the Optical Society of America, Volume 28, Number 7, July, 1938, page 215. Ives mentions that Einstein was working with canal rays "over 30 years ago," which would have meant prior to 1908. Canal rays are a predecessor to today's atomic clocks.

[14] See the official web site of the Nobel Foundation for this award at: http://www.nobel.se/physics/laureates/1919/press.html

[15] Many people have used the works of Ayn Rand (Atlas Shrugged, etc.) to philosophically argue for the importance of "causality." One of many books that does just that is The Philosophic Corruption of Physics by David Harriman, who is a physicist and philosopher.

[16] Herbert, Nick, Faster Than Light, Superluminal Loopholes in Physics, Plume, pages 30-31.

[17] Rado, Steven, Aethro-Kinematics, Aethron Publishing Company, 1994, pages 254-258. While I do not agree with everything in his book, his development of formulas for resistance caused by ether is exceptional. See: http://www.aethro-kinematics.com/

[18] Cocke, W.J., "Relativistic Corrections for Terrestrial Clock Synchronization," Physical Review Letters, Volume 16, Number 15, Page 662ff

[19] http://home.planetinternet.be/~pin30390/ (go to: /belgacom.htm) To my knowledge, information about his experiment has never been published.

[20] Van Flandern, Tom, Dark Matter, Missing Planets & New Comets, North Atlantic Books, read his preface for a scathing denunciation of general relativity.

[21] Agathangelidis, Antonis, "Implications of Hafele-Keating, Michelsom-Morley, & Michelson-Gale Experiments," Galilean Electrodynamics (GED), Vol 12, Number 3, May/June 2001, pages 43-49. Antonis also wondered why the center of the sun was not chosen. Antonis was not the first person to see a possible connection between the Hafele-Keating experiment and ether. My awareness of the Hafele-Keating experiment came from the first edition of an extremely rare pro-ether book by Gordon L. Ziegler: Formulating the Universe. This book is one of two books I know of that claim ether can easily explain the "Unified Theory." It is now in its second edition. It is virtually impossible that Agathangelidis knew of the Ziegler book, so it is fairly clear that they came to their conclusions independently. Ziegler's current web site is at: http://www.olywa.net/unifieduniverse/
Just before I finished writing the first edition of this book I got an email from Gordon Ziegler:
"The 1994 edition of Formulating the Universe, Volume I is on Google, the 1998 editions of Formulating the Universe, Volumes I and II are on Excite. All of these, however, are grossly out of date, since I have made many corrections and revisions to the originals. Now, also, I have the beginnings of Volume III. The current masters are not on the computer. I plan on submitting them to be published. I have yet a major revision to do. You might want to wait until I get this new revision done ... Dr. [name withheld because I don't have his permission] in London reviewed the current three volumes and called them 'magnificent, brilliant.'"

[22] Whitaker, Andrew, Einstein, Bohr and the Quantum Dilemma, Press Syndicate, University of Cambridge, pages 123-125. This is the best source I have found for explaining the switch from the ether theory to the photon theory in 1923 and 1924.

[23] I should warn the reader that doing this experiment was not as easy as it sounds, it is somewhat tricky to do it right. See Appendix A for details on how to do the experiment.

[24] Goldhaber, Alfred S., Nieto, Michael M., "The Mass of the Photon," Scientific American, Volume 234, Number 5, (May, 1976) pages 86ff

[25] Special thanks to Jerry Wiant, the Project Engineer at MLRS who acted as a go-between for my many questions to the MLRS observers and himself. See: http://almagest.as.utexas.edu/~rlr/mlrs.html

Three of the best articles I have found on the retro-reflector and Lunar Laser Ranging are the following:

[26] James E. Faller (who designed the retro-reflector), E. Joseph Wampler, "The Lunar Laser Reflector," Scientific American, Volume 222, Number 3, March 1970, page 38ff.

[27] C. O. Alley, P. L. Bender, J. E. Faller, et. al., "Laser Ranging Retroreflector," which is Chapter 7 in NASA Special Publication SP-214, 1969, called Apollo 11 - Preliminary Science Report.

[28] Dickey, J.O., Bender, P.L., Wiant, J.R., et.al., "Lunar Laser Ranging: A Continuing Legacy of the Apollo Program," Science, Vol. 265, July 22, 1994, pages 482-490.

[29] Ditchburn, R.W., Light, Dover Publications, 1991, page 561

[30] Special thanks to Bob Sandy of the Astronomical Society of Kansas City. I have studied Bob's detailed graphs of occultation “grazes” called “pictorial reductions.” Grazes on the moon occur when a bright star grazes the north or south edge of the moon and the star’s light actually flickers on and off due to the star's light passing between and behind several mountains silhouetted on the edge of the moon. Several astronomers, several miles from each other, observe the same occultation graze. All observations are later plotted on a piece of paper showing a silhouette of the mountains. Each astronomer videotapes their observations as atomic clock synchronized beeps (from radio station WWV or WWVB) are recorded on the videotape. Both actual and predicted data are plotted on the "pictorial reduction." Looking at the Bob's pictorial reductions and his videotapes, it is clear that the moon's ether drag does not bend the light of a star significantly, or at all, as its light grazes the moon.

# Appendix A

# Replicating the Kehr Experiments

"All truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. Third, it is accepted as being self-evident."
Arthur Schopenhauer (1788-1860)

## General Information For Everyone

Replicating my two types of experiments is actually quite simple, however, there are some very important things that must be done right or the experiment will fail.

This experiment can be done with a laser or a telescope, but do not use both for safety reasons. The key to a successful experiment is to understand the importance of the stability of the ***platform*** the laser or telescope and mirrors are on. The stability of the target is far less significant, though not even this can be totally ignored. Instability of the platform the laser or telescope is on can be caused by using a table or tripod with any wood in it (because wood slowly compresses when it has weight on it), by putting the table or tripod on a surface that is not absolutely stable (such as on an asphalt road during the day), by doing the experiment in an environment that does not have overall stability (such as inside a high rise building), etc.

For example, in our early experiments the laser was bolted to a wooden table. We placed a concrete block above each wooden table leg to stabilize it and compress the wooden legs. In doing a 72-hour experiment, it was clear that the wood did not completely compress during the first 48 hours. It was only during the third day that we got any kind of stability in our beam. At the time we did not know just how sensitive the experiment was to stability issues, nor did I know I should have been looking for a dot.

As another example, in two of our outdoor laser experiments we placed the laser table on an asphalt road. Unknown to us at the time is that asphalt expands when it gets cold (sic) and contracts when it gets hot (sic). Plus the wood table the laser was sitting on compressed during the experiment.

Likewise, the first telescope tripod we used was a wooden tripod. The wood on the tripod compressed during the 24 hours, thus throwing off the experiment.

Also, during our earliest telescope experiments, the telescope was placed on carpet (sic). With hindsight, the carpet obviously compressed during the

experiment. (Dare I admit that for one experiment I taped a telescope to a file cabinet and had a thick pile of paper between the telescope and the metal file cabinet?)

Another problem with the telescope experiment was the tripod head. During one experiment there was torque in the head of a metal tripod, and this torque released during the experiment, throwing off our measurements.

In another case the telescope was not balanced properly on the tripod head and this caused the telescope to drop ever so slightly during the experiment.

In another case, the telescope was placed on a concrete floor (wrapped around a weight bearing post) on the third floor of a nine-story building. I didn't know that the sun and outside temperatures caused the entire building to twist and move up and down slightly over the 24-hour period. Furthermore, tall buildings are designed to bend with the wind.

In short, we made a lot of mistakes before we figured out how to get the incredible stability we needed for the laser or telescope and mirrors.

It is clear that the laser or telescope must be put on a steel tripod or steel table or concrete block. But even that is not enough. The tripod, table or block must be sitting on a concrete or rock foundation. The entire experiment must be done underground or on the first floor of a one-story building. But even that is not enough. If it is sitting on concrete, the concrete must be right next to a weight bearing wall or the concrete must be poured directly on top of the ground. The reason it really should be underground has to do with the necessary constant temperature of the air and floor and the temperature of the tripod. A stable temperature, stable equipment and stable ground are absolutely required. There is simply no way that the experiment can be done outdoors because of temperature fluctuations. The ideal location would be deep inside of a cave, where there are rock foundations that each piece of equipment can be placed on.

It is clear than everything associated with the table or tripod has to be metal or concrete. Everything has to be perfectly balanced, it has to be locked down tight, and cannot have any torque. Everything involved with the experiment must be placed on weight bearing concrete (no air space can be beneath the concrete) or solid rock. As I said, the experiment ideally should be underground or in a large one-story building.

The target does not need that kind of stability, although I would put the target on a concrete floor (it does not need to be near a weight bearing wall or be concrete poured on dirt).

If using mirrors, the mirrors should have virtually the same stability as the telescope or lasers. It is critical that the mirrors to not tilt or twist during the experiment.

Photographing the experiment with a web cam, digital video recorder, etc. is critical, unless someone wants to baby-sit the experiment all night long and physically put a dot on the target each hour. Fortunately, web cams are almost ubiquitous. Likewise, personal computers are ubiquitous. The problem with web cams is that even a low powered laser beam will saturate the image, making it white and the image may even blur the entire screen. When using a helium-neon laser, there is no way I could have used a web cam. Even when using a red-beamed Torpedo Laser-Level the image came out white.

## For High School and College Undergraduates

When I first requested funding in 1997 I asked for $16,000 for a telescope, camera, tape recorder, etc. In 1998, when I asked for funding again, I asked for $4,000 for a helium-neon laser, several wooden targets, labor to build the very special targets, and other things. Today, my experiment can be done with a budget of about $100, excluding any web cam or computer.

The laser that is needed is called a "Torpedo Laser Level," or something akin to one. It is used in construction as a very long bubble level. These can be purchased from a company such as "Calpac Lasers" (http://www.calpaclasers.com/) or at a large hardware store. The mirrors are called "Elliptical Flat Secondary Mirrors" and are used to build telescopes. They can be purchased from a company like "Orion Telescopes and Binoculars" at: http://www.telescope.com/. The laser should cost about $60.00 and each mirror should cost about $10.00. The metal box that the mirrors are put ***outside of*** are standard electrical boxes.

My Torpedo Laser Level worked at home during a 48 hour test. But when we went to an experiment site it died after 14 hours. I still don't know if it died because of the power converter. I strongly suggest buying the very inexpensive ($12 or so) power supply or adapter from the same company the laser is purchased from. That way if there is a problem there is only one place to go.

## For Graduate Students and Professionals (Very High Precision)

A telescope is better than a laser, in fact don't even consider a laser. This is because a telescope of sufficient magnification can see a pinhole at several hundred feet. But a laser beam expands (i.e. beam divergence), even with a collimator. But in any case, it is always difficult to measure where the center of a laser beam is.

The target for the telescope should be grid paper, or some other type of paper with lines that can be easily seen and are pre-measured. You essentially pick a point on the grid paper and zoom in on that point. Using telescopes, the movement that point (on the CCD image) during the experiment is what you are looking for. The point on the target must be recorded by a CCD camera.

The last experiment we did with a telescope used an 8" f10 Schmidt-Cassegrain telescope with a 2X Barlow and a CCD camera. The experiment was done about 15 feet underground and measurements were taken every 15 minutes. At 300' the maximum point movement was less than 1/20th of an inch. No pattern was detected at that magnification, all motion was random. Part of the movement may have been caused by one of the tripod legs being a couple of feet away from the weight bearing post and thus this leg moved slightly up and down with the concrete floor during the experiment. In fact all of the movement of the point in this experiment may have been because of this.

I think the next level of equipment from what I have used would be a 12" f15 Schmidt-Cassegrain telescope with a 5X Barlow. This equipment would require a very high resolution, high quality CCD camera. I would not have any people in the section of the cave or mine where the experiment was being conducted because of body heat and breath heat. Furthermore I would let the equipment and temperature stabilize for two days before beginning the experiment. The experiment would last several days to establish the consistency of any pattern. I would light the target with light that generates very low heat. In fact, instead of using grid paper you might want to consider using LED lights.

If the experiment must be outdoors, astronomers have considerable experience in the subject of concrete bases. Field geologists can also add valuable input. Clearly, some very deep concrete or rock section must be found. The concrete or rock must in the shade all day long and every attempt must be made to keep the temperature stable around the telescope (this would require heat and air conditioning inside of a tent or building with the telescope pointed out of a door or open window).

The paradox is that ***the more powerful the telescope, the more stable the floor and equipment need to be*****!** It would do no good to get a huge telescope if it is not going to have a massively strong base, put on a rock floor hundreds of feet underground, where the temperature is very stable for days or thousands of years at a time.

In doing this experiment there should never be any pattern because of ether drag. This is because the vector of the line between the telescope and target are constant relative to the rotation of the earth underneath the ether drag. The amount of sensitivity needed is far to great to try and rotate the equipment on a platform.