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The Mount-Wilson Experiment:

A Detailed Analysis of the Main Theoretical Predictions

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Abstract:

In this review of the Mount-Wilson experiment, the related mathematical formulas, for calculating the fringe-shift displacement, have been derived, in accordance with the assumption of constant speed of light, and the assumption of ballistic speed of light, respectively. And the numerical results have been obtained, by inserting into the derived formulas the relevant data, gathered by the COBE satellite, regarding Earth's velocity, relative to the ***CMBR***. The computed predictions, at the geographical latitudes — 7.2º S, 34.2264º N, 41.4993º N, & 82.8º N — have been compared to the experimental result, in Miller's report. Subsequently, it's concluded that Dayton C. Miller's work, on the determination of the space motion of the earth, is of the same level of accuracy and validity as Ole Rømer's work, on the determination of the speed of light, and bound to be officially recognized as such, at some point in the future.

Keywords:

Orbital velocity; fringe shift; constant speed of light; ether drift; interferometry; Earth's absolute velocity; the CMBR apex; the ecliptic; space motion; Miller's experimental report; ballistic speed of light.

Introduction:

According to Dayton C. Miller's working hypothesis, the fringe patterns, expected to be observed in experiments similar to the Michelson-Morley experiment, as well as to his own Mount-Wilson experiment, should show periodic displacements proportional to the squared ratio of the velocity of the earth, relative to the ether, and the velocity of light, in vacuum, whenever the interferometer rotates, around an axis perpendicular to the floor of the laboratory, in which those experiments are carried out.

Furthermore, the axis perpendicular to the floor of the laboratory, itself, due to the diurnal rotation of Earth, around its geometrical axis, changes its direction, continuously, and makes a total angular displacement equal to 2π radians (***360º***), every ***23*** hours, ***56*** minutes, & and ***4.1*** seconds, with respect to the stars.

In addition, no more than two components of the ***3-D*** vector of Earth's resultant velocity, relative to the ether, can lie within the horizontal plane of the laboratory; and as a result, only one or two components of that velocity can be expected to produce interference fringes, at the moment of each experimental run.

But what will happen, in such Michelson-Morley-like experiments, if the vector of the earth's velocity, with respect to the ether, coincides, perfectly, with the perpendicular axis to the floor of the laboratory?

According to Dayton C. Miller, and, also, according to Albert A. Michelson and Edward W. Morley as well, no effect whatsoever, in that particular case, is possible to be observed, by the methods of this sort of interferometry, at all.

Nonetheless, it's, certainly, possible, in theory, as well as, in practice, to flip over the whole experimental apparatus on its side, in order to bring back, at once, into the geometrical plane of the slowly rotating interferometer, one or two of the vector components of Earth's velocity resultant [***Ref. #17***].

Anyway, the specific version of the ether-drift hypothesis, adopted by Dayton C. Miller, is, seemingly, on the face of it, somewhat vague and incapable of making detailed and definitive theoretical predictions, with regard to the motion of the earth, relative to the ether, in advance.

And consequently, Dayton C. Miller's modus operandi, throughout the Mount-Wilson experimental runs, seems, for the most part, to have been: Collect the experimental data first; and devise the working hypothesis later. And that modus operandi is, of course, very good for the quality of the collected data, in question, and for the scientific integrity of Miller, himself, as a highly skilled and quite competent experimenter. But, at the same time, such a working procedure tends to make the ether-drift hypothesis look, from any theoretical viewpoint, ad hoc, weak, and not to be taken very seriously.

As a matter of fact, the tentative nature of the aforementioned version of the ether-drift hypothesis, as employed by Dayton C. Miller, in the Mount-Wilson experiment, has encouraged a number of researchers, who came after him, in this field, to invent their own more or less tentative hypotheses, and to explain away his experimental data and reported results, as heat distortions and thermal artifacts [***Ref. #14***]; byproducts of outdated and faulty statistical procedures [***Ref. #2***]; effects of Earth's absolute motion through the quantum foam [***Ref. #10***]; electromagnetically-induced directionally-dependent anisotropies of the speed of light [***Ref. #12***]; effects of temperature gradient caused by the motion of the solar system through the Cosmic Background Radiation (CBR) [***Ref. #22***]; and so on and so forth.

However, regardless of how, disturbingly, anomalous and out of sync with the prevailing physical theories, his experimental findings, really, are, it's all but impossible, for anybody, to justifiably put Dayton C. Miller in the same category, or side by side with the physicist, Prosper-René Blondlot [***Ref. #21***], or to dismiss his reported results, out of hand, as if they were some N-ray type of illusions, or caused by some misconceptions, strong theoretical biases, or false predictions; firstly, because his working hypothesis makes no calculated predictions, beforehand; and secondly, because Dayton C. Miller, himself, had done everything, in this regard, according to the strict rules, and had taken extraordinary measures to ensure the objectivity and the integrity of this scientific work of his [***Ref. #2 & #7***].

In any case, the main objective of the present investigation is to determine by how much, exactly, the calculated predictions, on the basis of the assumption of constant speed of light, according to which the speed of light is independent of the speed of the light source, and on the basis of the assumption of ballistic speed of light, according to which the speed of light is dependent upon the speed of the light source, are greater than, or less than the experimental result, reported by Dayton C. Miller, in his Mount-Wilson experiment, in all the cases, in which the official value of Earth's velocity, relative to the Cosmic Microwave Background Radiation, is inserted, as a given, at various geographical latitudes, into the mathematical formulas, derived in accordance with each of those two assumptions, respectively.

The following section is a summary of Dayton C. Miller's experimental report.

1. Dayton Miller's Experimental Report:

As illustrated in ***Figure #1*** bellow, in the Mount-Wilson experiment, a light beam is, emitted by the light source, ***S***, collimated by the lens, ***L***, and then split, by the half-silvered mirror, ***D***, into two beams, propagating at right angles to each other, and labeled as Beam ***I*** and beam Beam ***II*** [***Ref. #1.c***].

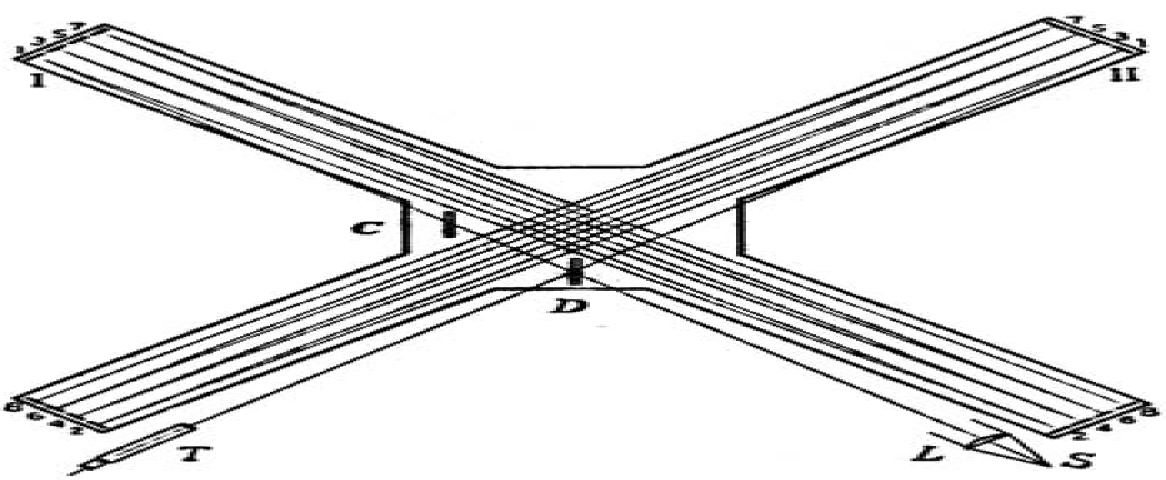

Figure #*1*: An illustration of light paths in the Mount-Wilson Experiment

In order to increase the total light path, for each beam, from ***4*** meters to ***64*** meters, along the two arms of the interferometer, Dayton C. Miller employed, in his Mount-Wilson experiment, four sets of mirrors — numbered from ***1*** to ***8*** — to reflect Beams ***I*** and Beam ***II***, back and forth, ***16*** times, before finally being recombined by the half-silvered mirror, ***D***, and reflected to the eyepiece of the small telescope, ***T***, through which the interference fringes can be observed.

In addition, Dayton C. Miller placed and floated the whole experimental apparatus on a circular tank filled with liquid mercury, in order to minimize friction, during its rotation along the periphery of a circle that has been divided into ***15*** sections, at each of which the ring of a small bell automatically sounded, for the purpose of facilitating the readings, organizing the measurements into distinct sets, and averaging the experimental data, on the basis of sidereal time, and celestial co-ordinates [***Ref. #1.a; 1.b; 1.c***].

Based on about ***5,000*** measurements made, at the astronomical observatory on the 5***710***-foot summit of Mount Wilson, California, between the year ***1921*** and the year ***1925***, Dayton C. Miller arrived at the preliminary and, somewhat, conservative conclusion that there is, indeed, a positive fringe shift, equivalent to an amount of relative motion of approximately ***10 km/s***; which is produced by a time difference of about $\boldsymbol{1.19 \times 10^{-16}\ s}$ between the total travel time of the beam ***I*** and the total travel time of beam ***II***, in the Mount-Wilson experiment.

And by ***1933***, however, Dayton C. Miller concluded that, within the theoretical framework of the ether-drift hypothesis, a fringe displacement equivalent to about ***10 km/s***, implies, necessarily, that the earth is moving with a speed of about ***208 km/s***, towards an apex at the right ascension: ***4*** hrs ***54*** min, and the celestial declination: ***-70° 33'***, in the southern constellation of Dorado, and about *7°* from the southern pole of the ecliptic [***Ref. #1.b***].

And, finally, here is a brief list of the essential aspects of the Mount-Wilson experiment, according to Dayton C. Miller's experimental report:

- The various runs of the Mount-Wilson experiment were carried out, by Dayton C. Miller, at the astronomical observatory, on the summit of Mount Wilson, California, at ***1,740*** meters above sea level.

- Dayton C. Miller's experimental apparatus was ***4.3*** meters across, and standing ***1.5*** meters in height [***Ref. #5***].

- The walls at the level of the light path were open to the air, or covered with canvas. Only glass, or glass and light paper covers were used along the light-beam paths, with all wood or metal shielding removed.

- The source of light, in the Mount-Wilson experiment, was a large acetylene lamp of the kind commonly used for automobile headlights, during the early decades of the 20th century.

- At the Mount-Wilson Observatory, in California, Dayton C. Miller made four distinct groups of observations, in March and April ***1921***, in November and December ***1921***, in August and September ***1924***, and in March and April ***1925*** [***Ref. #1.c***].

- On the basis of Dayton C. Miller's ether-drift hypothesis, it's assumed that the fringe-shift patterns, as the interferometer rotates in the horizontal plane, should exhibit a periodic displacement proportional to the relative motion of the earth and the ether. Moreover, the rotation of the earth, around its geometrical axis, causes the plane of the interferometer to move as though it were on the surface of a cone, the axis of which coincides with that of the earth, and takes many different space orientations. However, only the component of the actual drift that lies in the horizontal plane of the interferometer at the moment of observation, can be observed. And consequently, the apparent azimuth and the magnitude of the drift should change with the time of observation. While, at the same time, any drift perpendicular to the plane of the interferometer would not produce any effect at all; and this particular condition may occur at certain times of the year [***Ref. #8***].

- According to Dayton C. Miller's experimental report, the interferometer readings give, directly by harmonic analysis, the azimuth and the magnitude of the ether drift. There are no corrections of any kind to be applied to the observed values. In this work , every reading of the drift made at Mount Wilson has been included at its full value; no observation has been omitted because it seemed to be poor, and no weights have been applied to reduce the influence on the result, since no assumption has been made as to the expected result. In addition, while the readings are being made, neither the observer nor the recorder can form the slightest idea as to whether any periodicity is present, much less as to the direction or amount of such periodicity.

- The ***1600*** observations of the ether drift made in April ***1925***, consisting of ***35*** sets made on different days, have been combined into eleven sets at different sidereal times, and are charted in azimuth with respect to sidereal time in **Figure #*2***. The curve, shown below, has been drawn arbitrarily to indicate that there is a definite relation. This curve is of the kind that would correspond to some definite direction and velocity of ether drift. The observations for the other three epochs, while not so numerous, give curves wholly consistent with this one [***Ref. #1.a***].

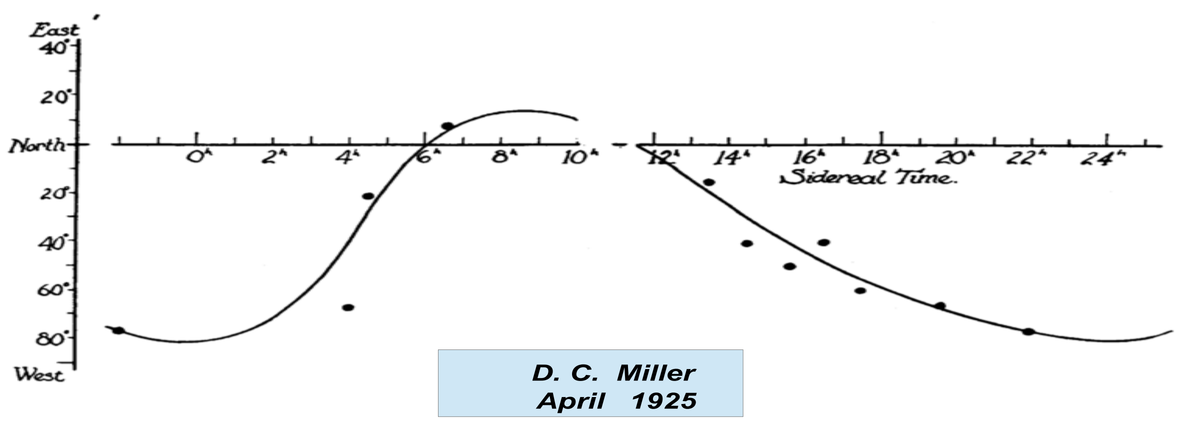

Figure #*2:* Fringe-shift Variations - charted in azimuth with respect to sidereal time

- The test of these observations is whether they lead to consistent indication of a constant motion of the solar system in space, combined with the orbital motion of the earth and the daily rotation on its axis. There is a specific relation for a given latitude between the observed azimuth of drift and the sidereal time of observation. Observations at different sidereal times should show different azimuths and all observations at the same sidereal time should show the same azimuth, for a given epoch. The ***1600*** observations of the ether drift, made in April ***1925***, consisting of ***35*** sets, made on different days, have been combined into eleven sets, at different sidereal times, and are charted in azimuth with respect to sidereal time in **Figure #*2***. The curve shown has been drawn arbitrarily to indicate that there is a definite relation. This curve is of the kind that would correspond to some definite direction and velocity of ether drift. The observations for the other three epochs, while not so numerous, give curves wholly consistent with this one [***Ref. #8***].

- The maximum value of the fringe-shift variations, in the Mount-Wilson experiment, occurs, around the ***5**th* hour of sidereal time, and the minimum occurs, around ***17**th* hour of sidereal time.

In the following sections, the experimental result, reported above, by Dayton C. Miller, will be compared to the theoretical predictions, computed on the basis the assumption of constant speed of light, according to which the speed of light is independent of the speed of the light source, as defined within the framework of the classical wave theory, as well as, on the basis of the assumption of ballistic speed of light, according to the speed of light is dependent upon the speed of the light source, as defined within the framework of the elastic-impact emission theory, respectively.

2. The Computed Predictions on the Assumption of Constant Speed of Light:

Let the light source, ***S***, emit the initial experimental beam, in the Mount-Wilson experiment, towards the half-silvered mirror, ***D***, with the speed of light, ***c***, and in the same direction as that of the velocity resultant of the earth, ***v***.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

There are two major cases that have to be treated, separately, and investigated, here, in detail, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory:

A. The case, in which the two light beams, I & II, travel in vacuum:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of Earth's velocity resultant, ***v***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity vector, ***v***.

And, therefore, if the length of the horizontal path is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{c} = \frac{L}{c - v}$$

where c is the speed of light, in vacuum; and v is the resultant velocity of the earth.

And likewise, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{c} = \frac{L}{c + v}$$

where L is the length of the light path.

And accordingly, the total travel time of the beam ***I***, is equal to t:

$$t = t_1 + t_2 = \frac{L}{c - v} + \frac{L}{c + v} = \frac{2L}{c\left(1 - \frac{v^2}{c^2}\right)}$$

where c is the speed of light, in vacuum; and v is the total space velocity of the earth.

And similarly, if the length of the transverse path, in the Mount-Wilson experiment, is equal to L, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)^2}}{c} = \frac{2L}{\sqrt{c^2 - v^2}} = \frac{2L}{c\sqrt{1 - \frac{v^2}{c^2}}}$$

where vt_3 is the base of the isosceles triangle whose height is equal to L.

And it follows, therefore, that the numerical value of the time difference, Δt, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained, on the basis of the assumption of constant speed of light, through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}}}{1-\frac{v^2}{c^2}}\right)$$

where ***t*** is the total travel time, for the slower beam ***I***; and t_3 is the total travel time, for the faster beam ***II***.

B. The case, in which the two light beams, I & II, travel in air:

Here, also, there are two major cases that have to be investigated, in detail:

1. The case, in which, the Fresnel coefficients are being neglected:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity, ***v***.

And, therefore, if the length of the horizontal light path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first part of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{\frac{c}{n}} = \frac{nL}{c - nv}$$

where ***c*** is the speed of light, in vacuum; ***n*** is the refractive index of air; and ***v*** is the resultant velocity of the earth.

And in the same way, the travel time of the beam ***I***, during the second part of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{\frac{c}{n}} = \frac{nL}{c + nv}$$

where ***L*** is the length of the light path.

And accordingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{nL}{c - nv} + \frac{nL}{c + nv} = \frac{2nL}{c\left(1 - \frac{n^2 v^2}{c^2}\right)}$$

where ***n*** is the refractive index; ***c*** is the speed of light, in vacuum; and ***v*** is the total velocity of the earth.

Likewise, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2} v t_3\right)^2}}{\frac{c}{n}} = \frac{2nL}{\sqrt{c^2 - n^2 v^2}} = \frac{2nL}{c\sqrt{1 - \frac{n^2 v^2}{c^2}}}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the velocity resultant of the earth.

And it follows, therefore, that, according to the assumption of constant speed of light, the numerical difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in any repetition of the Mount-Wilson experiment, carried out in the refracting medium of air, with the Fresnel coefficients being neglected, can be obtained through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2nL}{c\left(1 - \frac{n^2 v^2}{n^2 c^2}\right)} - \frac{2nL}{c\sqrt{1 - \frac{n^2 v^2}{c^2}}} = \frac{2nL}{c\sqrt{1 - \frac{n^2 v^2}{c^2}}}\left(\frac{1 - \sqrt{1 - \frac{n^2 v^2}{c^2}}}{1 - \frac{n^2 v^2}{c^2}}\right)$$

where ***n*** is the refractive index of air; ***t*** is the total time of flight, for the beam ***I***; and t_3 is the total time of flight, for the beam ***II***.

2. The case, in which, the Fresnel coefficients are being taken into account:

There are two experimentally verified Fresnel coefficients, for light traveling through a refracting medium in motion:

- For light traveling in the same direction as that of the moving medium:

$$\frac{c}{n'} = \frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)$$

where ***n*** is the refractive index, in a refracting medium at rest; ***n'*** is the refractive index of the same refracting medium in motion; ***c*** is the speed of light, in vacuum; and ***v*** is the velocity of the moving refracting medium, relative to the laboratory.

- For light traveling in the opposite direction to that of the moving medium:

$$\frac{c}{n'} = \frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)$$

where ***n*** is the refractive index, in a stationary refracting medium; ***n'*** is the refractive index, in a moving refracting medium; ***c*** is the speed of light, in vacuum; and ***v*** is the velocity of the moving refracting medium, with respect to the reference frame of the laboratory.

And although, in the surveyed literature, only the angle of incidence of 0^o and the angle of incidence of 180^o have been treated quantitatively, it's quite easy to obtain, by the method of mathematical induction, from the two formulas, above, the following general formula, for calculating the Fresnel coefficients, at other angles of incidence:

$$\frac{c}{n'} = \sqrt{\frac{c^2}{n^2} + \left(v\left(1 - \frac{1}{n^2}\right)\right)^2 + 2v\left(1 - \frac{1}{n^2}\right)\left(\frac{c}{n}\right)\cos(i)}$$

where ***i*** is the angle of incidence, for the traveling light, with respect to the velocity vector of the refracting medium, ***v***; and ***n*** is the refractive index of the stationary refracting medium.

However, it's, certainly, much more difficult to find, anywhere, in the published literature, or to come up, somehow, on the basis of the assumption of constant speed of light, with straightforward and satisfactory answers to these two crucial questions:

1. Does a mirror, placed, properly, inside a refracting medium, in motion, reflect back, in accordance with the assumption of constant speed of light, the incident light beam with the same velocity; i.e.,

$$\frac{c}{n'} = \frac{c}{n} \pm v\left(1 - \frac{1}{n^2}\right)$$

within the same refracting medium?

2. Or does that same mirror, based on the assumption of constant speed of light, act as a new light source, for the incident light beam, under investigation?

And even though, at first glance, the conjecture, which states that the aforementioned mirror should act as a new light source, seems to be quite plausible and more consistent with the assumption of constant speed of light, it is not possible, on theoretical grounds alone, to rule out, completely, any possibility of elastic-impact type of reflection, based on this same assumption, as defined within the framework of the classical wave theory.

For the sake of comparison, therefore, let these two possibilities, be treated, here, on equal footing.

I. The reflecting mirror acts as a new source of light:

In this case, it's assumed that the mirror, under investigation, reflects incident beams with the speed of light, in the refracting medium; i.e.,

$$\frac{c}{n}$$

where n is the refractive index; and c is the speed of light, in vacuum.

Let the beam, ***I***, be transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***; while the beam, ***II***, be reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity vector of the refracting medium, ***v***.

And, therefore, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to L, then the travel time of the beam ***I***, during the first round of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{\frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)} = \frac{L}{\frac{c}{n} - \frac{v}{n^2}} = \frac{n^2 L}{nc - v}$$

where c is the speed of light, in vacuum; n is the refractive index of air; and v is the resultant velocity of the earth.

And in the same way, the travel time of the beam ***I***, during the second round of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{\frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)} = \frac{L}{\frac{c}{n} + \frac{v}{n^2}} = \frac{n^2 L}{nc + v}$$

where ***L*** is the length of the light path.

And accordingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{n^2 L}{nc - v} + \frac{n^2 L}{nc + v} = \frac{2nL}{c\left(1 - \frac{v^2}{n^2 c^2}\right)}$$

where ***n*** is the refractive index; ***c*** is the speed of light, in vacuum; and ***v*** is the total velocity of the earth.

And in a like manner, if the length of the transverse path, in the aforementioned experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2} v t_3\right)^2}}{\sqrt{\frac{c^2}{n^2} + \left(v\left(1 - \frac{1}{n^2}\right)\right)^2}} = \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)}}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the resultant velocity of the earth.

And it follows, therefore, that the numerical difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in any repetition of the Mount-Wilson experiment, conducted in the refracting medium of air, with the Fresnel coefficients being taken into consideration, can be obtained through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2nL}{c\left(1 - \frac{v^2}{n^2 c^2}\right)} - \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)}} = \frac{2nL}{c}\left(\frac{\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)} + \frac{v^2}{n^2 c^2} - 1}{\left(1 - \frac{v^2}{n^2 c^2}\right)\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)}}\right)$$

where ***t*** is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

II. The mirror reflects incident light with the same velocity:

In this case, it's assumed that the mirror, under investigation, reflects incident beams with the same velocity; i.e.,

$$\frac{c}{n} \pm v\left(1-\frac{1}{n^2}\right)$$

where ***n*** is the refractive index; ***v*** is the velocity of the refracting medium; and ***c*** is the velocity of light, in vacuum.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity, ***v***.

And, accordingly, if the length of the horizontal path is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{\frac{c}{n} + v\left(1-\frac{1}{n^2}\right)} = \frac{nL}{c\left(1-\frac{v}{nc}\right)}$$

where ***c*** is the speed of light, in vacuum; ***n*** is the refractive index of air; and ***v*** is the resultant velocity of the earth.

The beam ***I*** is reflected, by the mirror, with the same resultant velocity; i.e.,

$$\frac{c}{n} + v\left(1-\frac{1}{n^2}\right)$$

And subsequently, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{\left[\frac{c}{n} + v\left(1-\frac{1}{n^2}\right)\right] - \left[v\left(1-\frac{1}{n^2}\right)\right]} = \frac{nL}{c\left(1+n\frac{v}{c}\right)}$$

where ***L*** is the length of the light path.

And consequently, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{2nL}{c}\left(\frac{1+\frac{v}{c}\left(\frac{n^2-1}{2n}\right)}{\left(1-\frac{v}{nc}\right)\left(1+\frac{nv}{c}\right)}\right)$$

where ***n*** is the refractive index; ***c*** is the speed of light, in vacuum; and ***v*** is the total velocity of the earth.

Now, in order to obtain the total travel time of the beam ***II***, it's necessary to calculate the velocity, in the transverse direction, by inserting the cosine of the angle ***90º***, along with the following reflected velocity value:

$$\frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)$$

into this general equation, for computing the Fresnel coefficients, at other angles of incidence:

$$\frac{c}{n'} = \sqrt{\frac{c^2}{n^2} + \left(v\left(1-\frac{1}{n^2}\right)\right)^2 + 2v\left(1-\frac{1}{n^2}\right)\left(\frac{c}{n}\right)\cos(i)}$$

where ***i*** is the angle of incidence, for the traveling light, with respect to the velocity vector of the refracting medium, ***v***; and ***n*** is the refractive index of the stationary refracting medium.

And correspondingly, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)^2}}{\sqrt{\left[\frac{c}{n} + v\left(1-\frac{1}{n^2}\right)\right]^2 + \left[v\left(1-\frac{1}{n^2}\right)\right]^2}} = \frac{2nL/c}{\sqrt{1+2\frac{v}{c}\left[n-\frac{1}{n}+\frac{v}{c}\left(n^2+\frac{1}{n^2}-2\right)\right]}}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the resultant velocity of the earth.

And it follows, therefore, that the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2nL}{c}\left(\frac{1+\frac{v}{c}\left(\frac{n^2-1}{2n}\right)}{\left(n-\frac{v}{c}\right)\left(1+n\frac{v}{c}\right)} - \left(\sqrt{1+2\frac{v}{c}\left[n-\frac{1}{n}+\frac{v}{c}\left(n^2+\frac{1}{n^2}-2\right)\right]}\right)^{-1} \right)$$

where t is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

It should be noted, within this context, that, according to the assumption of constant speed of light, in all of the above cases, the total travel time of the beam ***I*** is, always, larger than the total travel time of the beam ***II***.

3. The Computed Predictions on the Assumption of Ballistic Speed of Light:

Let the light source, ***S***, emit the initial experimental beam, in the Mount-Wilson experiment, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c***, and in the same direction as that of the velocity resultant of the earth, ***v***.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

There are two main cases that have to be investigated, here, in detail, and treated, separately, on the basis of the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory:

A. The case, in which the two light beams, I & II, travel in vacuum:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity, ***v***.

And, therefore, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{c+v} = \frac{L}{c}$$

where ***c*** is the muzzle speed of light, in vacuum; and ***v*** is the resultant velocity of the earth.

And likewise, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{c - v} = \frac{L}{c}$$

where ***L*** is the length of the light path.

And accordingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{2L}{c}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the total space velocity of the earth.

And similarly, if the length of the transverse path, in the aforementioned experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)^2}}{\sqrt{c^2 + v^2}} = \frac{2L}{c}$$

where vt_3 is the base of an isosceles triangle, the height of which is equal to ***L***.

And it follows, therefore, that, according to the assumption of ballistic speed of light, the computed numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, conducted in vacuum, is, always, equal to ***0***:

$$\Delta t = t_3 - t = 0$$

where ***t*** is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

B. The case, in which the two light beams, I & II, travel in air:

As demonstrated, above, in accordance with the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, no fringe-shift displacement can be observed, in all cases, in which the Mount-Wilson experiment is carried out in vacuum.

And accordingly, only the cases, in which the experiment, under discussion, is carried out, in the refracting medium of air, will be investigated further, on the basis of the aforementioned assumption, throughout this discussion.

There are two main cases that have to be treated, in detail, in this section:

1. The case, in which, the Fresnel coefficients are not taken into account:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, crosswise, at right angles to the direction of the velocity, ***v***.

And, therefore, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first part of its round trip, is equal to t_1:

$$t_1 = \frac{L + vt_1}{\frac{c+v}{n}} = \frac{nL}{c - v(n-1)}$$

where c is the muzzle speed of light, in vacuum; n is the refractive index of air; and v is the resultant velocity of the earth.

And in the same way, the travel time of the beam ***I***, during the second part of its round trip, is equal to t_2:

$$t_2 = \frac{L - vt_2}{\frac{c-v}{n}} = \frac{nL}{c + v(n-1)}$$

where L is the length of the light path.

And subsequently, the total travel time of the beam ***I***, is equal to t:

$$t = t_1 + t_2 = \frac{nL}{c - v(n-1)} + \frac{nL}{c + v(n-1)} = \frac{2nL}{c\left(1 - \frac{v^2}{c^2}(n-1)^2\right)}$$

where n is the refractive index; c is the speed of light, in vacuum; and v is the total velocity of the earth.

And furthermore, if the length of the transverse path, in the aforementioned experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)^2}}{\sqrt{\left(\frac{c}{n}\right)^2 + \left(\frac{v}{n}\right)^2}} = \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)}}$$

where vt_3 is the base of the isosceles triangle whose height is equal to ***L***, and the two equal sides of which constitute the total path of the beam ***II***, in the Mount-Wilson experiment.

And it follows, therefore, that the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = t_3 - t = \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)}} - \frac{2nL}{c\left(1 - \frac{v^2}{c^2}\left(n - 1\right)^2\right)} = \frac{2nL}{c}\left(\frac{\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\right) - \sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)}}{\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\right)\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)}}\right)$$

where t is the total travel time, for the faster beam ***I***; and t_3 is the total travel time, for the slower beam ***II***.

2. The case, in which, the Fresnel coefficients are taken into account:

On the basis of the ballistic assumption, in accordance with which the speed of light is dependent upon the speed of the light source, this standard equation, for the calculation of the Fresnel coefficients:

$$\frac{c}{n'} = \frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)$$

for light traveling in the same direction as that of the moving medium;

as well as this standard equation, for computing the Fresnel coefficients:

$$\frac{c}{n'} = \frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)$$

for light traveling in the opposite direction to that of the moving medium; where, in both equations, n is the refractive index, in a stationary refracting medium; n' is the refractive index, in a moving refracting medium; c is the muzzle speed of light, in vacuum; and v is the velocity of the moving refracting medium; are applicable, only, to the special case, in which the refracting medium, in question, is in motion; and, at the same time, the light source and the measuring apparatus are at rest, with respect to the reference frame of the laboratory.

However, in the case of the Mount-Wilson experiment, the light source, the measuring apparatus, along with the refracting medium, are all moving with the same speed in the same direction.

And since, within the theoretical framework of the elastic-impact emission theory, the absolute numerical values of the Fresnel coefficients are, by their very definition, in direct proportion to the absolute numerical values of the this part of the velocity difference, Δv:

$$\Delta v = nv - v = v(n-1)$$

between the velocity of incident light, on one hand, and the velocity of the refracting medium as well as the velocity of the reflecting mirror, on the other hand; the Fresnel coefficients, in the case of the Mount-Wilson experiment, carried out in air, have to be reformulated, accordingly, in this way:

$$v\left(\frac{n^2-1}{n^2}\right)(n-1) = v\left(n + \frac{1}{n^2} - \frac{1}{n} - 1\right)$$

where n is the refractive index of air; and v is the resultant velocity of the earth.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, v; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity, v.

And, therefore, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to L, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1}{\frac{c+v}{n} + v(n-1)\left(1 - \frac{1}{n^2}\right)} = \frac{L}{c\left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]}$$

where c is the muzzle speed of light, in vacuum; n is the refractive index of air; and v is the resultant velocity of the earth.

Upon reflection, by the moving mirror, the two Fresnel coefficients, according to the assumption of ballistic speed of light, cancel each other out; and correspondingly, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2}{\frac{c - v}{n}} = \frac{L}{c\left(\frac{1 - v/c}{n} + \frac{v}{c}\right)}$$

where ***L*** is the length of the light path.

And accordingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{L}{c\left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]} + \frac{L}{c\left(\frac{1-v/c}{n} + \frac{v}{c}\right)} = \frac{L}{c}\left(\frac{\left(\frac{1-v/c}{n} + \frac{v}{c}\right) + \left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]}{\left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]\left(\frac{1-v/c}{n} + \frac{v}{c}\right)}\right)$$

where ***n*** is the refractive index; ***c*** is the muzzle speed of light, in vacuum; and ***v*** is the total velocity of the earth.

And likewise, if the length of the vertical path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)^2}}{\sqrt{\left[\frac{c}{n} + v(n-1)\left(1-\frac{1}{n^2}\right)\right]^2 + \left[\frac{v}{n} + v(n-1)\left(1-\frac{1}{n^2}\right)\right]^2}} = \frac{2L}{c\sqrt{\left[\frac{1}{n} + \frac{v}{c}(n-1)\left(1-\frac{1}{n^2}\right)\right]^2 + \frac{v^2}{c^2}\left[\frac{1}{n} + (n-1)\left(1-\frac{1}{n^2}\right)-1\right]^2}}$$

where ***c*** is the muzzle speed of light, in vacuum; and ***v*** is the resultant velocity of the earth.

And it follows, therefore, that the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$t_3 - t = \frac{2L}{c}\left(\frac{\left(\left(\frac{1-v/c}{n} + \frac{v}{c}\right) + \left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]\right) - \frac{1}{2}\sqrt{\left[\frac{1}{n} + \frac{v}{c}(n-1)\left(1-\frac{1}{n^2}\right)\right]^2 + \frac{v^2}{c^2}\left[\frac{1}{n} + (n-1)\left(1-\frac{1}{n^2}\right)-1\right]^2}}{\sqrt{\left[\frac{1}{n} + \frac{v}{c}(n-1)\left(1-\frac{1}{n^2}\right)\right]^2 + \frac{v^2}{c^2}\left[\frac{1}{n} + (n-1)\left(1-\frac{1}{n^2}\right)-1\right]^2}\left[\frac{1+v/c}{n} + \frac{v}{c}\left((n-1)\left(1-\frac{1}{n^2}\right)-1\right)\right]\left(\frac{1-v/c}{n} + \frac{v}{c}\right)}\right)$$

where ***t*** is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

It should be pointed out, within the current context, that, according to the assumption of ballistic speed of light, the total travel time of of the slower beam ***II*** is, always, larger than the travel time of the faster beam ***I***.

4. The Main Procedures for Computing the Predicted Results:

In order to calculate the above predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, as well as, in accordance with the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory; and then, to compare the obtained numerical results to the reported experimental result of the Mount-Wilson experiment, the following procedures will be employed, throughout the current investigation:

1. Assume that the fringe-shift displacement, reported by Dayton C. Miller, in the Mount-Wilson experiment, is caused, by the same velocity of the planet Earth, relative to the Cosmic Microwave Background Radiation (***CMBR***), as measured by the methods of Doppler spectroscopy. And accordingly, make use of the following data, as obtained by the COBE satellite [***Ref. #19***]:

$$v = 370600 \pm 400 \quad \text{ms}^{-1}$$
$$(l, b) = (264.31^o \pm 0.17^o, 48.05^o \pm 0.10^o)$$
$$RA = 11^h\ 12^m, \quad Dec = -7.20^o$$

where ***v*** is the velocity of Earth, relative to the CMBR; ***l*** is the galactic longitude; ***b*** is the galactic latitude; ***RA*** is the right ascension; and ***Dec*** is the equatorial declination.

2. Use the sixth-magnitude star, Psi Crateris (***ψ Crt***), located at the equatorial co-ordinates — Right ascension: ***11***h ***12***m ***30.37188***s & Declination: ***-18º 29' 5995"*** — as a celestial marker for, the rising, the setting, the celestial altitude, as well as the direction of the apex of Earth's velocity, relative to the CMBR, with respect to the meridian of the laboratory.

3. Calculate the numerical results, for the theoretical predictions, according to the assumption of constant speed of light, and the assumption of ballistic speed of light, respectively, at the geographical latitude, ***7.2º S***, where the apex, for Earth's velocity relative to the CMBR, passes through the zenith, vertically, over head; and where the daily fringe-shift variations, due to the change in the direction of the CMBR apex, with respect to the meridian of the laboratory, take their clearest and most distinct sinusoidal form.

4. Obtain the numerical results, through the use of derived mathematical formulas, on the basis of the assumption of constant speed of light, as well as on the basis of the assumption of ballistic speed of light, for a repetition of the Mount-Wilson experiment, conducted, in vacuum, and in the refracting medium of air, respectively, at the geographical latitude of ***7.2º S***; and then, compare each numerical result to the experimental result, reported by Dayton C. Miller.

5. Based on the numerical results, obtained by using the derived mathematical formulas, on the basis of the assumption of constant speed of light, and the assumption of ballistic speed of light, for a repetition of the Mount-Wilson experiment, carried out, in vacuum, and in the refracting medium of air, respectively, at the geographical latitude of ***7.2º S***; if two or more mathematical formulas, on each assumption, give very close numerical results, then, in order to simplify the calculations and to avoid redundancy, in this regard, select, only, the simplest mathematical formula, in each case, and apply it, throughout the rest of the present investigation, to all calculations, at other geographical latitudes.

6. Calculate the numerical results, for the theoretical predictions, on the basis of the assumption of constant speed of light, as well as, on the basis of the assumption of ballistic speed of light, respectively, for the original Mount-Wilson experiment, on the summit of Mount Wilson, CA, at the geographical latitude, ***34.2264º N***, and the geographical longitude, ***118.0642º W***; and then compare the obtained numerical results to the experimental result, reported by Dayton C. Miller.

7. Compute, one more time, the numerical results, for the same theoretical predictions, in accordance with the assumption of constant speed of light, as well as, in accordance with the assumption of ballistic speed of light, respectively, for the repetition of the Mount-Wilson experiment, in Cleveland, OH, at the geographical latitude, ***41.4993º N***, and the geographical longitude, ***81.6944º W***; and then compare the obtained numerical results to the experimental result, reported by Dayton C. Miller, as well as, to the experimental result, reported by Albert A. Michelson and Edward W. Morley.

8. Compute the numerical results, for the same theoretical predictions, in accordance with the assumption of constant speed of light, and the assumption of ballistic speed of light, respectively, at the geographical latitude, ***82.8º N***; where the apex, for Earth's velocity relative to the CMBR, never rises above the horizon of the laboratory; and where the velocity vector of Earth is, always, within the horizontal plane of the slowly rotating interferometer, in the Mount-Wilson experimental apparatus.

9. Calculate the seasonal fringe-shift variations, due to the orbital motion of the earth, around the barycenter of the solar system, on the basis of the assumption of constant speed of light, as well as, on the basis of the assumption of ballistic speed of light, respectively, for a repetition of the Mount-Wilson experiment, at the geographical latitude of ***7.2º S***, and then compare the obtained numerical results to the experimental result, reported by Dayton C. Miller.

10. Calculate the seasonal fringe-shift variations, due to the orbital motion of the earth, around the barycenter of the solar system, on the basis of the assumption of constant speed of light, as well as, on the basis of the assumption of ballistic speed of light, respectively, for the original Mount-Wilson experiment, on the summit of Mount Wilson, CA, at the geographical latitude, ***34.2264º N***, and the geographical longitude, ***118.0642º W***; and then compare the obtained numerical results to the experimental result, reported by Dayton C. Miller.

It should be emphasized, in this regard, that the primary objective of the present investigation is to compare the numerical results of the computed predictions, on the assumption of constant speed of light, and on the assumption of ballistic speed of light, to the reported numerical result of the Mount-Wilson experiment, in order to find out which of the two assumption is more consistent with the experimental result, in question; and, more importantly, to determine whether or not the measured fringe-shift displacement, in the Mount-Wilson experiment, itself, is consistent with the dipole pattern, due to Earth's velocity, with respect to the Cosmic Microwave Background Radiation (CMBR), as measured, many years later, through its Doppler effect.

5. Computed Results on the Assumption of Constant Speed of Light at 7.2º S:

As mentioned earlier, the latitude of ***7.2º S*** is the only geographical latitude, along which the apex of Earth's velocity relative to the CMBR, is at its zenith; i.e., the direction of its vector coincides, exactly, with the plummet line and the direction of the gravitational acceleration, ***g***, at the earth's surface.

And since the horizontal plane of the interferometer, in the Mount-Wilson experiment, coincides, always, with the earth's surface, it must make, at the geographical latitude of ***7.2º S***, an angle of ***90º*** with the velocity vector of Earth, ***v***, each time the CMBR apex is either at its zenith, or at its nadir with respect to the opposite side of the earth.

And therefore, at the geographical latitude of ***7.2º S***, the amount of fringe-shift displacement, due to Earth's velocity with respect to the CMBR, is nil, during the time, in which the CMBR apex is either at its zenith, or at its nadir; because the vector of Earth's velocity relative to the CMBR, during that time, is, necessarily, at right angles to the two arms of the slowly rotating interferometer, in the Mount Wilson experimental apparatus.

By contrast, the amount of fringe-shift displacement, due to Earth's velocity relative to the CMBR, has its maximum value, at the geographical latitude of ***7.2º S***, during the time, in which the CMBR apex is either at the eastern horizon, or at the western horizon, with respect to the meridian of the the laboratory; because the vector of Earth's velocity, relative to the CMBR, lies within the horizontal plane of the slowly interferometer

It follows, therefore, that, at the geographical latitude of ***7.2º S***, if ***θ*** stands for the celestial altitude of the CMBR apex, with respect to the meridian of the laboratory, then the numerical values of the fringe-shift displacement must vary with the cosine of ***θ***; because the amount of Earth's velocity, ***v***, relative to the CMBR, within the horizontal plane of the interferometer, varies, constantly, during each rotation of Earth, around its geometrical axis, with the cosine of the angle, ***θ***.

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** and let ***θ*** denote the angle of the celestial altitude of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory, at the geographical latitude of ***7.2º S***.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

There are two main cases that have, here, to be investigated, in detail, and treated, separately, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory:

1. The case, in which the two light beams, I & II, travel in vacuum:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***vcos(θ)***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity vector, ***vcos(θ).***

And, therefore, at the geographical latitude of ***7.2º S***, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first round of its trip, is equal to t_1:

$$t_1 = \frac{L + vt_1 \cos(\theta)}{c} = \frac{L}{c - v\cos(\theta)}$$

where ***c*** is the speed of light, in vacuum; and ***θ*** is the celestial altitude of the apex of Earth's velocity, ***v***, relative to the CMBR.

Likewise, the travel time of the beam ***I***, during the second round of its trip, is equal to t_2:

$$t_2 = \frac{L - vt_2 \cos(\theta)}{c} = \frac{L}{c + v\cos(\theta)}$$

where ***L*** is the length of the light path.

And correspondingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{L}{c - v\cos(\theta)} + \frac{L}{c + v\cos(\theta)} = \frac{2L}{c\left(1 - \frac{v^2}{c^2}\cos^2(\theta)\right)}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the velocity of the earth, relative to the CMBR.

And similarly, at the geographical latitude of ***7.2º S***, if the length of the transverse path, in this experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left[\frac{1}{2}vt_3 \cos(\theta)\right]^2}}{c} = \frac{2L}{c\sqrt{1 - \frac{v^2}{c^2}\cos^2(\theta)}}$$

where vt_3 is the base of an isosceles triangle, the height of which is equal to ***L***; and ***θ*** is the celestial altitude of the apex of the CMBR.

And it follows, therefore, that, at the geographical latitude of ***7.2º S***, the numerical difference, Δt, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, carried out in vacuum, can be obtained through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2L}{c\left(1-\frac{v^2}{c^2}\cos^2(\theta)\right)} - \frac{2L}{c\sqrt{1-\frac{v^2}{c^2}\cos^2(\theta)}} = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\cos^2(\theta)}}{1-\frac{v^2}{c^2}\cos^2(\theta)}\right)$$

where ***t*** is the total time of flight, for the beam ***I***; and t_3 is the total time of flight, for the beam ***II***.

By convention, the angular values, for the celestial altitude, range from ***0º***, at the eastern horizon, and the western horizon, as well; to ***90º***, at the zenith; i.e., the spot, on the celestial sphere, directly overhead.

However, in the Mount-Wilson experiment, if the light source emits its light, in the direction of the velocity, ***v***, when the CMBR apex is at the eastern horizon, then the same light source, due to the rotation of the earth, must emit its light, at the western horizon, in the opposite direction to that of the velocity vector, ***v***; and vice versa.

And subsequently, the angle, ***θ***, in the above equations, is assumed, within the current context, to have its starting point (e.g. ***0º***), at the horizon, in which the direction of emitted light coincides with the direction of the velocity vector of the CMBR apex, ***v***, and to be measured clockwise from ***0º*** to ***360º***, in order for the cosine function, under discussion, to include all the numerical values of the fringe-shift displacement, and to adequately describe the fringe-shift variations, throughout the daily sidereal period of ***23*** hours, ***56*** minutes, and ***4.1*** seconds.

It follows, therefore, that the predicted numerical results, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, for a repetition of the Mount-Wilson experiment, carried out in vacuum, at the geographical latitude, ***7.2º S***, can be calculated, by inserting the following numerical data:

$$c = 299792458 \ \ \text{ms}^{-1}$$

$$v = 371000 \ \ \ \text{ms}^{-1}$$

$$L = 32.000 \ \ \ \text{m}$$

$$0^o \le \theta \le 360^0$$

into this mathematical formula:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\cos^2(\theta)}}{1-\frac{v^2}{c^2}\cos^2(\theta)}\right)$$

in which ***Δt*** is the time difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; ***v*** is Earth's velocity, with respect to the CMBR; ***θ*** is the angle of the celestial altitude of the CMBR apex; and ***c*** is the speed of light, in vacuum.

From the equation, above, it's clear, at once, that, according to the assumption of constant speed of light, as defined within the framework of the classical wave theory, at these two values of ***θ***:

$$\theta = 90^o$$

$$\theta = 270^o$$

the computed numerical result, for the predicted difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, is equal to ***0***; i.e., no fringe-shift displacement, due to Earth's velocity relative to the CMBR, at the geographical latitude of ***7.2º S***, can be observed at the moment, in which the CMBR apex crosses the zenith, ***90º***, directly, overhead; or it crosses the nadir, ***270º***, directly above the antipodal side of the earth.

Furthermore, according to the same equation, at the following two values of ***θ***:

$$\theta = 0^o$$

$$\theta = 180^o$$

the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, has its maximum numerical value, in a repetition of the Mount-Wilson experiment, carried out in vacuum, at the geographical latitude, ***7.2° S***; i.e.,

$$\Delta t = 1.63469 \times 10^{-13} \quad \text{s}$$

And therefore, all the computed numerical results, in accordance with the assumption of constant speed of light, for the predicted difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, in a repetition of the Mount-Wilson experiment, in vacuum, at the geographical latitude of ***7.2º S***, are within the following numerical range:

$$0 \le \Delta t \le 1.63469 \times 10^{-13} \quad \text{s}$$

Moreover, the daily variations, in the fringe-shift displacement, due to the changing direction of the CMBR apex, with respect to the meridian of the laboratory, at the geographical latitude of ***7.2º S***, form a sinusoidal function, which repeats itself, every sidereal day, as illustrated in **Figure *#3***, below:

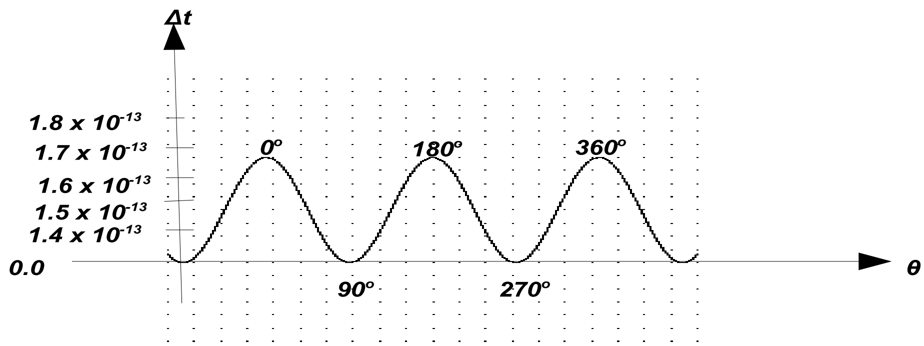

Figure ***#3:*** Daily fringe-shift variations at ***7.2º S***

In addition, the results of the numerical difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in a repetition of the Mount-Wilson experiment, in vacuum, at the geographical latitude, ***7.2º S***, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*1***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	**$1.525x10^{-13}$**	**$1.226x10^{-13}$**	**$8.173x10^{-14}$**	**$4.087x10^{-14}$**	**$1.095x10^{-14}$**	**$1.095x10^{-14}$**	**$4.087x10^{-14}$**	**$8.173x10^{-14}$**	**$1.226x10^{-13}$**	**$1.525x10^{-13}$**

Table #1*: Computed values of Δt at the zenith side*

And, also, the computed results, for the numerical difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the nadir side, are listed in **Table #*2***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**$1.525x10^{-13}$**	**$1.226x10^{-13}$**	**$8.173x10^{-14}$**	**$4.087x10^{-14}$**	**$1.095x10^{-14}$**	**$1.095x10^{-14}$**	**$4.087x10^{-14}$**	**$8.173x10^{-14}$**	**$1.226x10^{-13}$**	**$1.525x10^{-13}$**

Table #2*: Computed values of Δt at the nadir side*

It must be concluded, therefore, that, at the geographical latitude, ***7.2º S***, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, around the zenith, within this numerical range:

$$80^o \leq \theta \leq 100^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, around the nadir, within this numerical range:

$$260^o \leq \theta \leq 280^o$$

the computed predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, are consistent with the experimental result of ***1.19 x 10⁻¹⁶ s***, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

However, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, within these two numerical ranges, on the zenith side:

$$0^o \leq \theta \leq 30^o$$

$$150^o \leq \theta \leq 180^o$$

as well as, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, within these two ranges, on the nadir side:

$$180^o \leq \theta \leq 210^o$$

$$330^o \leq \theta \leq 360^o$$

the computed predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, are about ***1000*** times greater than ***1.19 x 10⁻¹⁶ s***; and hence, they're, considerably, inconsistent with the reported experimental result of ***1.19 x 10⁻¹⁶ s***, as obtained by Dayton C. Miller, in the Mount-Wilson experiment; and, subsequently, a helper hypothesis, such as the aforementioned ether-drift hypothesis, is imperative, in this regard.

2. The case, in which the two light beams, I & II, travel in air:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***vcos(θ)***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity vector, ***vcos(θ).***

And, therefore, at the geographical latitude of ***7.2***° ***S***, if the length of the horizontal path is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1\cos(\theta)}{\frac{c}{n}} = \frac{nL}{c - nv\cos(\theta)}$$

where c is the speed of light, in vacuum; n is the refractive index for air; and θ is the celestial altitude of the apex of Earth's velocity, v, relative to the CMBR.

And in a like manner, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2 \cos(\theta)}{\frac{c}{n}} = \frac{nL}{c + nv\cos(\theta)}$$

where L is the length of the light path.

And correspondingly, at the geographical latitude of ***7.2º S***, the total travel time of the beam ***I***, is equal to t:z:

$$t = t_1 + t_2 = \frac{nL}{c - nv\cos(\theta)} + \frac{nL}{c + nv\cos(\theta)} = \frac{2nL}{c\left(1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)\right)}$$

where c is the speed of light, in vacuum; and v is the velocity of the earth, relative to the CMBR.

And similarly, at the geographical latitude of ***7.2º S***, if the length of the transverse path, in the experiment, under discussion, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\right)}}{\frac{c}{n}} = \frac{2nL}{c\sqrt{1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)}}$$

where n is the refractive index; and θ is the celestial altitude of the apex of the CMBR.

And it follows, therefore, that the numerical difference, Δt, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, at the geographical latitude of ***7.2º S***, can be obtained through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2nL}{c\left(1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)\right)} - \frac{2nL}{c\sqrt{1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)}} = \frac{2nL}{c}\left(\frac{1 - \sqrt{1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)}}{1 - n^2 \frac{v^2}{c^2}\cos^2(\theta)}\right)$$

where ***t*** is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

It follows, at the geographical latitude of ***7.2º S***, therefore, that the predicted numerical results, on the basis of assumption of constant speed of light, as defined within the framework of the classical wave theory, for the Mount-Wilson experiment, carried out in air, can be calculated, by inserting the following numerical data:

$$c = 299792458 \ \text{ms}^{-1}$$
$$v = 371000 \ \text{ms}^{-1}$$
$$L = 32.000 \ \text{m}$$
$$n = 1.00029$$
$$0^{\circ} \le \theta \le 360^{o}$$

into this mathematical formula:

$$\Delta t = \frac{2nL}{c}\left(\frac{1 - \sqrt{1 - \frac{v^2}{c^2} n^2 \cos^2(\theta)}}{1 - \frac{v^2}{c^2} n^2 \cos^2(\theta)}\right)$$

in which ***Δt*** is the difference between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; ***v*** is Earth's velocity, with respect to the CMBR; ***θ*** is the angle of the celestial altitude as defined above; ***n*** is the refractive index of air; and ***c*** is the speed of light, in vacuum.

From the equation, above, it's, immediately, clear that, based on the assumption of constant speed of light, as defined within the framework of the classical wave theory, at these two values of ***θ***:

$$\theta = 90^{o}$$
$$\theta = 270^{o}$$

the computed numerical result, for the predicted difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, at the geographical latitude of ***7.2º S***, is equal to ***0***; i.e., no fringe-shift displacement, due to Earth's velocity relative to the CMBR, can be observed, during the time, in which the CMBR apex crosses the zenith, ***90º***, directly, overhead; or it crosses the nadir, ***270º***, directly above the antipodal side of the earth.

In addition, according to the same equation, at the following two values of $\boldsymbol{\theta}$:

$$\theta = 0^o$$
$$\theta = 180^o$$

the time difference, $\boldsymbol{\Delta t}$, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, has its maximum value, for a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude, $\boldsymbol{7.2^o}$ ***S***; i.e.,

$$\Delta t = 1.63564 \times 10^{-13} \quad \text{s}$$

And therefore, all the computed numerical results, in accordance with the assumption of constant speed of light, for the predicted difference, $\boldsymbol{\Delta t}$, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, in a repetition of the Mount-Wilson experiment, at the geographical latitude, $\boldsymbol{7.2^o}$ ***S***, are within the following numerical range:

$$0 \le \Delta t \le 1.63564 \times 10^{-13} \quad \text{s}$$

The results of the numerical difference, $\boldsymbol{\Delta t}$, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in any repetition of the Mount-Wilson experiment, conducted in the refracting medium of air, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of $\boldsymbol{\theta}$, at the zenith side, are listed in **Table #*3***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	$1.527\text{x}10^{-13}$	$1.227\text{x}10^{-13}$	$8.181\text{x}10^{-14}$	$4.090\text{x}10^{-14}$	$1.096\text{x}10^{-14}$	$1.096\text{x}10^{-14}$	$4.090\text{x}10^{-14}$	$8.181\text{x}10^{-14}$	$1.227\text{x}10^{-13}$	$1.527\text{x}10^{-13}$

Table #*3:* ***Computed values of Δt at the zenith side***

And the computed results, at the geographical latitude of $\boldsymbol{7.2^o}$ ***S***, for the numerical difference, $\boldsymbol{\Delta t}$, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of $\boldsymbol{\theta}$, at the nadir side, are listed in **Table #*4***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	$1.527\text{x}10^{-13}$	$1.227\text{x}10^{-13}$	$8.181\text{x}10^{-14}$	$4.090\text{x}10^{-14}$	$1.096\text{x}10^{-14}$	$1.096\text{x}10^{-14}$	$4.090\text{x}10^{-14}$	$8.181\text{x}10^{-14}$	$1.227\text{x}10^{-13}$	$1.527\text{x}10^{-13}$

Table #*4:* ***Computed values of Δt at the nadir side***

We conclude, therefore, that, at the geographical latitude of ***7.2***° ***S***, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, around the zenith, within this numerical range:

$$80^o \leq \theta \leq 100^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, around the nadir, within this numerical range:

$$260^o \leq \theta \leq 280^o$$

the computed predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, are, generally, consistent with the experimental result of $\boldsymbol{1.19 \times 10^{-16}\ s}$, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

Nonetheless, at the geographical latitude of ***7.2***° ***S***, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, within these two numerical ranges, on the zenith side:

$$0^o \leq \theta \leq 30^o$$

$$150^o \leq \theta \leq 180^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, within these two numerical ranges, on the nadir side:

$$180^o \leq \theta \leq 210^o$$

$$330^o \leq \theta \leq 360^o$$

the numerical values of the computed prediction, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, are, on average, about ***1000*** times greater than $\boldsymbol{1.19 \times 10^{-16}\ s}$; and hence, in the absence of an additional hypothesis, those numerical values are, definitely, inconsistent with the reported experimental result of $\boldsymbol{1.19 \times 10^{-16}\ s}$, as obtained by Dayton C. Miller, in the Mount-Wilson experiment.

3. The two light beams, I & II, travel in air and affected by the Fresnel Coefficients:

The reflecting mirror is taken, here, for granted, to act as a new source, for the reflected light, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, $\boldsymbol{v\cos(\theta)}$; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity vector, ***vcos(θ).***

And, accordingly, at the geographical latitude of ***7.2º S***, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first part of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1\cos(\theta)}{\frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)\cos(\theta)} = \frac{nL}{c - \frac{v}{n}\cos(\theta)}$$

where ***c*** is the speed of light, in vacuum; ***n*** is the refractive index for air; and ***θ*** is the celestial altitude of the apex of Earth's velocity, ***v***, relative to the CMBR.

And likewise, the travel time of the beam ***I***, during the second part of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2\cos(\theta)}{\frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)\cos(\theta)} = \frac{nL}{c + \frac{v}{n}\cos(\theta)}$$

where ***L*** is the length of the light path.

And correspondingly, at the geographical latitude of ***7.2º S***, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{nL}{c - \frac{v}{n}\cos(\theta)} + \frac{nL}{c + \frac{v}{n}\cos(\theta)} = \frac{2nL}{c\left(1 - \frac{v^2}{n^2c^2}\cos^2(\theta)\right)}$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the velocity of the earth, relative to the CMBR.

And similarly, at the geographical latitude of ***7.2º S***, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2} v t_3 \cos(\theta)\right)^2}}{\sqrt{\frac{c^2}{n^2} + \left(v\left(1 - \frac{1}{n^2}\right)\cos(\theta)\right)^2}} = \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)}}$$

where ***c*** is the speed of light, in vacuum; and ***θ*** is the celestial altitude of the apex of the CMBR.

And it follows, therefore, that, at the geographical latitude of ***7.2º S***, the numerical difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in any repetition if the Mount-Wilson experiment, conducted in air with the Fresnel coefficients being taken into account, can be calculated through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2nL}{c\left(1 - \frac{v^2}{n^2c^2}\cos^2(\theta)\right)} - \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)}} = \frac{2nL}{c}\left(\frac{\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)} + \frac{v^2}{n^2c^2}\cos^2(\theta) - 1}{\left(1 - \frac{v^2}{n^2c^2}\cos^2(\theta)\right)\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)}}\right)$$

where ***t*** is the total travel time, for the slower beam ***I***; and t_3 is the total travel time, for the faster beam ***II***.

And therefore, the predicted numerical results, on the basis of assumption of constant speed of light, as defined within the framework of the classical wave theory, for any repetition of the Mount-Wilson experiment, carried out in air with the Fresnel coefficients being taken into consideration, at the geographical latitude of ***7.2º S***, can be calculated, by inserting the following observational data:

$$c = 299792458 \ \text{ms}^{-1}$$
$$v = 371000 \ \text{ms}^{-1}$$
$$L = 32.000 \ \text{m}$$
$$n = 1.00029$$
$$0^{\circ} \leq \theta \leq 360^{o}$$

into this mathematical formula:

$$\Delta t = \frac{2nL}{c}\left(\frac{\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)} + \frac{v^2}{n^2c^2}\cos^2(\theta) - 1}{\left(1 - \frac{v^2}{n^2c^2}\cos^2(\theta)\right)\sqrt{1 - \frac{v^2}{c^2}\left(2 - \frac{1}{n^2}\right)\cos^2(\theta)}}\right)$$

in which ***Δt*** is the difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection method; ***v*** is Earth's velocity, with respect to the CMBR; ***θ*** is the angle of the celestial altitude of the CMBR apex; ***n*** is the refractive index of air; and ***c*** is the speed of light, in vacuum.

From the equation, above, it's, at first glance, clear that, based on the assumption of constant speed of light, as defined within the framework of the classical wave theory, for these two numerical values of ***θ***:

$$\theta = 90^o$$

$$\theta = 270^o$$

the computed numerical values, in accordance with the assumption of constant speed of light, for the predicted time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, are equal to ***0***; i.e., no fringe-shift displacement, due to Earth's velocity relative to the CMBR, can be observed, at the geographical latitude of ***7.2º S***, during the time, in which the CMBR apex crosses the zenith, ***90º***, directly, overhead; or it crosses the nadir, ***270º***, directly above the antipodal side of the earth.

In addition, according to the same equation, for the following two values of ***θ***:

$$\theta = 0^o$$

$$\theta = 180^o$$

the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, has its maximum value, in a repetition of the Mount-Wilson experiment, carried out in air with the Fresnel coefficients being taken into account, at the geographical latitude of ***7.2º S***; i.e.,

$$\Delta t = 1.63232 \times 10^{-13} \quad \text{s}$$

And as a consequence, all the computed numerical results, in accordance with the assumption of constant speed of light, for the predicted difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, in the aforementioned repetition of the Mount-Wilson experiment, at the geographical latitude of ***7.2º S***, are within the following numerical range:

$$0 \le \Delta t \le 1.63232 \times 10^{-13} \quad \text{s}$$

The computed values of the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in a repetition of the Mount-Wilson experiment, in air with the effect of Fresnel coefficients taken into consideration, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*5***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	**$1.527x10^{-13}$**	**$1.224x10^{-13}$**	**$8.162x10^{-14}$**	**$4.081x10^{-14}$**	**$1.093x10^{-14}$**	**$1.093x10^{-14}$**	**$4.081x10^{-14}$**	**$8.162x10^{-14}$**	**$1.224x10^{-13}$**	**$1.523x10^{-13}$**

Table #5: ***Computed values of Δt at the zenith side***

And, also, the computed results, at the geographical latitude of ***7.2º S***, for the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the nadir side, are listed in **Table #*6***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**$1.527x10^{-13}$**	**$1.224x10^{-13}$**	**$8.162x10^{-14}$**	**$4.081x10^{-14}$**	**$1.093x10^{-14}$**	**$1.093x10^{-14}$**	**$4.081x10^{-14}$**	**$8.162x10^{-14}$**	**$1.224x10^{-13}$**	**$1.523x10^{-13}$**

Table #6: ***Computed values of Δt at the nadir side***

It should be concluded, therefore, that, at the geographical latitude of ***7.2º S***, during the time, in which the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, around the zenith, within this numerical range:

$$80^o \leq \theta \leq 100^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, around the nadir, within this numerical range:

$$260^o \leq \theta \leq 280^o$$

the numerical values of the calculated predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, is, without any additional hypothesis, consistent with the experimental result of ***1.19×10^{-16} s***, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

Nevertheless, at the geographical latitude of ***7.2º S***, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, within these two numerical ranges, on the zenith side:

$$0^o \leq \theta \leq 30^o$$

$$150^o \leq \theta \leq 180^o$$

and, also, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, within these two numerical ranges, on the nadir side:

$$180^o \leq \theta \leq 210^o$$

$$330^o \leq \theta \leq 360^o$$

the numerical values of the computed predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, are, in general, about ***1000*** times greater than $\boldsymbol{1.19 \times 10^{-16}\ s}$; and hence, they're, obviously, inconsistent with the reported experimental result of $\boldsymbol{1.19 \times 10^{-16}\ s}$, as measured by Dayton C. Miller, in the Mount-Wilson experiment; unless an additional hypothesis is introduced.

And so, finally, based on the above calculations, the following conclusions can be made:

- The difference between the computed maximum value of $\boldsymbol{\Delta t_v}$, at the geographical latitude of ***7.2***° ***S***, for a repetition of the Mount-Wilson experiment, carried out in vacuum, and the computed maximum value of $\boldsymbol{\Delta t_f}$, for the same experiment, carried out in air with the Fresnel coefficients being taken into account, is relatively small; i.e.,

  $$\Delta t_v - \Delta t_f = 2.3699 \times 10^{-16} \text{ s}$$

  And, in addition, the ratio between the computed maximum value of $\boldsymbol{\Delta t_v}$, at the geographical latitude of ***7.2***° ***S***, for a repetition of the Mount-Wilson experiment, carried out in vacuum, and the computed maximum value of $\boldsymbol{\Delta t_f}$, for the same experiment, carried out in air along with the Fresnel coefficients being taken into consideration, is close to ***1***; i,e.,

  $$\frac{\Delta t_v}{\Delta t_f} = 1.0015$$

  And therefore, neglecting the Fresnel coefficients, by Dayton C. Miller, in his published report, concerning the Mount-Wilson experiment, is justified.

- The numerical difference, at the geographical latitude of ***7.2***° ***S***, between the computed maximum value of $\boldsymbol{\Delta t_i}$, for a repetition of the Mount-Wilson experiment, carried out in air, and the computed maximum value of $\boldsymbol{\Delta t_v}$, for the same experiment, carried out in vacuum, is relatively small; i.e.,

$$\Delta t_i - \Delta t_v = 9.4826\times10^{-17} \ \ \text{s}$$

In addition, the ratio between the computed maximum value of ***Δt_i***, for a repetition of the Mount-Wilson experiment, carried out in air, and the computed maximum value of ***Δt_v***, for the same experiment, carried out in vacuum, at the geographical latitude of ***7.2*º *S***, is close to ***1***; i,e.,

$$\frac{\Delta t_i}{\Delta t_v} = 1.00058$$

And accordingly, neglecting refraction of air, in Dayton C. Miller's report, regarding the Mount-Wilson experiment, is justified.

It's to be concluded, therefore, that most of the computed theoretical predictions, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory, for a repetition of the Mount-Wilson experiment, at the geographical latitude of ***7.2*º *S***, are about ***1000*** times larger than the reported experimental result, regardless of whether the calculations, done with the mathematical formulas, for vacuum, or with the mathematical formulas, for the refracting medium of air; and regardless of whether the Fresnel coefficients have been taken into account, or have been neglected. And therefore, the ether-drift hypothesis, as devised by Dayton C. Miller, is a necessary helper hypothesis, for rendering the calculated results, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, consistent with the reported result of the Mount-Wilson experiment.

6. The Computed Results on the Assumption of Ballistic Speed of Light at 7.2º S:

As demonstrated earlier, at all geographical latitudes, according to the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, the predicted numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in any repetition of the Mount-Wilson experiment, conducted in vacuum, is, in all cases, nil; i.e.,

$$\Delta t = t_3 - t = 0$$

where t is the total travel time, for the beam ***I***; and t_3 is the total travel time, for the beam ***II***.

And subsequently, only the cases, in which the Mount-Wilson experiment is being carried out in air, will be treated further, quantitatively, in detail, in the following investigation.

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** and let θ denote the angle of the celestial altitude of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory, at the geographical latitude of ***7.2*º *S***.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in the experimental apparatus of Dayton C. Miller.

I. The two light beams, I & II, traveling through the refracting medium of air:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***vcos(θ)***; while the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the velocity vector, ***vcos(θ).***

Therefore,at the geographical latitude of ***7.2º S***, if the length of the horizontal path is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1\cos(\theta)}{\frac{c + v\cos(\theta)}{n}} = \frac{nL}{c - v(n-1)\cos(\theta)}$$

where c is the muzzle speed of light, in vacuum; n is the refractive index for air; and θ is the celestial altitude of the apex of Earth's velocity, v, relative to the CMBR.

And in the same manner, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2\cos(\theta)}{\frac{c - v\cos(\theta)}{n}} = \frac{nL}{c + v(n-1)\cos(\theta)}$$

where L is the length of the light path.

And correspondingly, the total travel time of the beam ***I***, is equal to t:

$$t = t_1 + t_2 = \frac{nL}{c - v(n-1)\cos(\theta)} + \frac{nL}{c + v(n-1)\cos(\theta)} = \frac{2nL}{c\left(1 - \frac{v^2}{c^2}(n-1)^2\cos^2(\theta)\right)}$$

where c is the speed of light, in vacuum; and v is the velocity of the earth, relative to the CMBR.

And similarly, if the length of the vertical path, in the Mount-Wilson experiment, is equal to ***L***, then, at the geographical latitude of ***7.2º S***, the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2} v t_3 \cos(\theta)\right)^2}}{\sqrt{\left(\frac{c}{n}\right)^2 + \left(\frac{v\cos(\theta)}{n}\right)^2}} = \frac{2nL}{c\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\cos^2(\theta)}}$$

where ***vt³*** is the base of an isosceles triangle, the height of which is equal to ***L***; ***c*** is the muzzle speed of light, in vacuum; and ***θ*** is the celestial altitude of the apex of the CMBR.

And it subsequently, at the geographical latitude of ***7.2º S***, the time difference, ***Δt***, between the total travel of the faster beam ***I***, and the total travel time of the slower beam ***II***, in a repetition of the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = t_3 - t = \frac{2nL}{c}\left(\frac{\left(1 - \frac{v^2}{c^2}(n-1)^2\cos^2(\theta)\right) - \sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\cos^2(\theta)}}{\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\cos^2(\theta)}\left(1 - \frac{v^2}{c^2}(n-1)^2\cos^2(\theta)\right)}\right)$$

where ***t*** is the total travel time, for the faster beam ***I***; and t_3 is the total travel time, for the slower beam ***II***.

It follows, therefore, that the predicted numerical results, on the basis of assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, for a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude of ***7.2º S***, can be calculated, by inserting the following numerical data:

$$c = 299792458 \ \text{ms}^{-1}$$
$$v = 371000 \ \text{ms}^{-1}$$
$$L = 32.000 \ \text{m}$$
$$\text{n} = 1.00029$$
$$0^\circ \leq \theta \leq 360^o$$

into this mathematical formula:

$$\Delta t = \frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\cos^2(\theta)\right)-\sqrt{1-\frac{v^2}{c^2}(n^2-1)\cos^2(\theta)}}{\sqrt{1-\frac{v^2}{c^2}(n^2-1)\cos^2(\theta)}\left(1-\frac{v^2}{c^2}(n-1)^2\cos^2(\theta)\right)}\right)$$

in which Δt is the difference between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***; L is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; v is Earth's velocity, with respect to the CMBR; θ is the angle of the celestial altitude of the CMBR apex; n is the refractive index of air; and c is the muzzle speed of light, in vacuum.

From the equation, above, it should be, at once, clear that, based on the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, for these two numerical values of θ:

$$\theta = 90^o$$

$$\theta = 270^o$$

the computed numerical values, at the geographical latitude of ***7.2º S***, for the predicted difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, is equal to ***0***; and thus, no fringe-shift displacement, due to Earth's velocity relative to the CMBR, can be observed around the time, during which the CMBR apex crosses the zenith, ***90º***, directly, overhead; or it crosses the nadir, ***270º***, directly above the antipodal side of the earth.

In addition, according to the same equation, for the following two values of θ:

$$\theta = 0^o$$

$$\theta = 180^o$$

the time difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, has its maximum value, for a repetition of the Mount-Wilson experiment, carried out in air, during the time, in which the CMBR apex is at the eastern horizon, or at the western horizon, with respect to the meridian of the laboratory, at the geographical latitude, ***7.2º S***; i.e.,

$$\Delta t = 9.48258\times10^{-17} \text{ s}$$

And therefore, all the computed numerical values, in accordance with the assumption of ballistic speed of light, for the predicted difference, Δt, between the total time of flight, for the beam ***I***, and total the time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, in any repetition of the Mount-Wilson experiment, conducted in air, at the geographical latitude of ***7.2º S***, are within the following numerical range:

$$0 \le \Delta t \le 9.48258\times10^{-17} \text{ s}$$

Moreover, the daily variations, in the fringe-shift displacement, due to the changing direction of the CMBR apex, with respect to the meridian of the laboratory, at the geographical latitude of *7.2º S*, form a sinusoidal function, which repeats itself, every sidereal day, as illustrated in **Figure #4**, below:

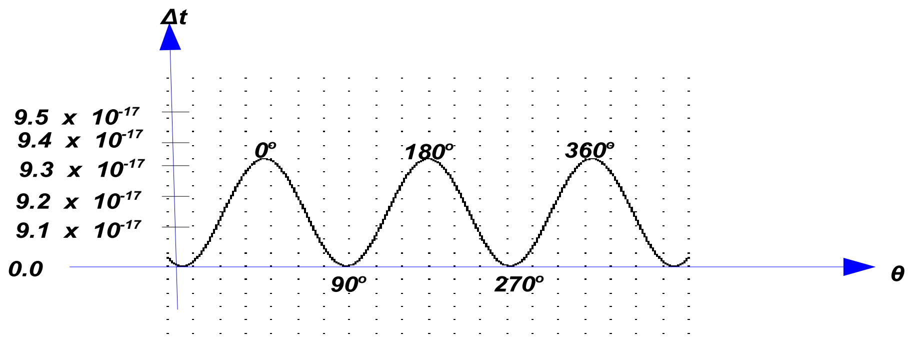

Figure #4: Daily fringe-shift variations at *7.2º S*

The results of the numerical difference, ***Δt***, between the time of flight, for the faster beam ***I***, and the time of flight, for the slower beam ***II***, due to Earth's motion relative to the CMBR, in a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude of *7.2º S*, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #7**, below:

Θ deg.	15º	30º	45º	60º	75º	105º	120º	135º	150º	165º
Δt sec.	$8.847\text{x}10^{-17}$	$7.112\text{x}10^{-17}$	$4.741\text{x}10^{-17}$	$2.371\text{x}10^{-17}$	$6.352\text{x}10^{-18}$	$6.352\text{x}10^{-18}$	$2.371\text{x}10^{-17}$	$4.741\text{x}10^{-17}$	$7.112\text{x}10^{-17}$	$8.847\text{x}10^{-17}$

Table #7: ***Computed values of Δt at the zenith side***

And, also, the calculated numerical values, for the time difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, at the geographical latitude of *7.2º S*, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of ***θ***, at the nadir side, are listed in **Table #8**, below:

Θ deg.	195º	210º	225º	240º	255º	285º	300º	315º	330º	345º
Δt sec.	$8.847\text{x}10^{-17}$	$7.112\text{x}10^{-17}$	$4.741\text{x}10^{-17}$	$2.371\text{x}10^{-17}$	$6.352\text{x}10^{-18}$	$6.352\text{x}10^{-18}$	$2.371\text{x}10^{-17}$	$4.741\text{x}10^{-17}$	$7.112\text{x}10^{-17}$	$8.847\text{x}10^{-17}$

Table #8: ***Computed values of Δt at the nadir side***

It has to be concluded, therefore, that, at the geographical latitude of *7.2º S*, during the time, in which the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, ***θ***, at the zenith side, within these twp ranges:

$$0^o \leq \theta \leq 30^o$$

$$150^o \leq \theta \leq 180^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, at the nadir side, within these two ranges:

$$180^o \leq \theta \leq 210^o$$

$$330^o \leq \theta \leq 360^o$$

the numerical values of the computed predictions, on the basis of the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, are, generally, consistent with the experimental result of ***1.19×10^{-16} s***, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

However, when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, within this numerical range, on the zenith side:

$$45^o \leq \theta \leq 135^o$$

as well as when the apex of Earth's velocity, relative to the CMBR, is at a celestial altitude, $\boldsymbol{\theta}$, within this numerical range, on the nadir side:

$$225^o \leq \theta \leq 315^o$$

the numerical values of the computed predictions, in accordance with the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, at the geographical latitude of ***7.2^o S***, are, generally, less than ***50%*** of the reported result; i.e., inconsistent with the reported experimental result of ***1.19×10^{-16} s***, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

II. Beams I & II, traveling in air & Fresnel coefficients taken into account:

As mentioned earlier, in the current discussion, in accordance with the assumption of ballistic speed of light, on the basis of which the speed of light is dependent upon the speed of the light, this standard equation, for the calculation of the Fresnel coefficients:

$$\frac{c}{n'} = \frac{c}{n} + v\left(1 - \frac{1}{n^2}\right)$$

for light traveling in the same direction as that of the moving medium;

as well as this standard equation, for computing the Fresnel coefficients:

$$\frac{c}{n'} = \frac{c}{n} - v\left(1 - \frac{1}{n^2}\right)$$

for light traveling in the opposite direction to that of the moving medium; where, in both, ***n*** is the refractive index, in a stationary refracting medium; ***n'*** is the refractive index, in a moving refracting medium; ***c*** is the muzzle speed of light, in vacuum; and ***v*** is the velocity of the moving refracting medium; are applicable, only, to the special case, in which the refracting medium, in question, is in motion; and, at the same time, the light source and the measuring apparatus are at rest, with respect to the reference frame of the laboratory.

However, in the case of the Mount-Wilson experiment, the light source and the measuring apparatus, along with the refracting medium, are all moving with the same speed in the same direction.

And since, within the theoretical framework of the assumption of ballistic speed of light, the absolute numerical values of the Fresnel coefficients are, by definition, in direct proportion to the absolute numerical values of the this part of the velocity difference, Δv:

$$\Delta v = nv - v = v(n-1)$$

between the velocity of incident light, and the reflecting mirror, in the experiment, under discussion; the Fresnel coefficients are reduced, accordingly, by a factor equal to ***(n – 1)***; i.e.,

$$v\left(\frac{n^2-1}{n^2}\right)(n-1) = v\left(n + \frac{1}{n^2} - \frac{1}{n} - 1\right)$$

where ***n*** is the refractive index of air; and ***v*** is the resultant velocity of the earth.

And, therefore, at the geographical latitude of ***7.2º S***, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first part of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1\cos(\theta)}{\frac{c + v\cos(\theta)}{n} + v(n-1)\left(1 - \frac{1}{n^2}\right)\cos(\theta)} = \frac{L}{\frac{c}{n} - v\cos(\theta)\left[\left(1 - \frac{1}{n}\right) - (n-1)\left(1 - \frac{1}{n^2}\right)\right]}$$

where ***c*** is the muzzle speed of light, in vacuum; ***n*** is the refractive index of air; ***θ*** is the celestial altitude of the apex of Earth's velocity, relative to the CMBR; and ***v*** is the resultant velocity of the earth.

Upon reflection, the two Fresnel coefficients cancel each other out; and hence, the travel time of the beam ***I***, during the second part of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2\cos(\theta)}{\frac{c - v\cos(\theta)}{n}} = \frac{L}{\frac{c}{n} + v\cos(\theta)\left(1 - \frac{1}{n}\right)}$$

where $\boldsymbol{L}$ is the length of the light path; and $\boldsymbol{\theta}$ is the celestial altitude of the CMBR apex.

And accordingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{2L}{c}\left(\frac{\frac{1}{n} + \frac{1}{2}\frac{v}{c}\cos(\theta)(n-1)\left(1 - \frac{1}{n^2}\right)}{\left[\frac{1}{n} - \frac{v}{c}\cos(\theta)\left(\left(1 - \frac{1}{n}\right) - (n-1)\left(1 - \frac{1}{n^2}\right)\right)\right]\left(\frac{1}{n} + \frac{v}{c}\cos(\theta)\left(1 - \frac{1}{n}\right)\right)}\right)$$

where $\boldsymbol{n}$ is the refractive index; $\boldsymbol{\theta}$ is the celestial altitude of the CMBR apex; $\boldsymbol{c}$ is the muzzle speed of light, in vacuum; and $\boldsymbol{v}$ is the total velocity of the earth.

And likewise, if the length of the vertical path, in the aforementioned experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to $\boldsymbol{t_3}$:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2}vt_3\cos(\theta)\right)^2}}{\sqrt{\left[\frac{c}{n} + v(n-1)\left(1 - \frac{1}{n^2}\right)\cos(\theta)\right]^2 + \left[\frac{v\cos(\theta)}{n} + v(n-1)\left(1 - \frac{1}{n^2}\right)\cos(\theta)\right]^2}}$$

where $\boldsymbol{vt_3\cos(\theta)}$ is the base of the isosceles triangle whose height is equal to ***L***.

And correspondingly:

$$t_3 = \frac{2L/c}{\sqrt{\left[\frac{1}{n} + \frac{v}{c}(n-1)\left(1 - \frac{1}{n^2}\right)\cos(\theta)\right]^2 + \frac{v^2\cos^2(\theta)}{c^2}\left[\left(\frac{1}{n} + (n-1)\left(1 - \frac{1}{n^2}\right)\right)^2 - 1\right]}}$$

where $\boldsymbol{c}$ is the muzzle speed of light, in vacuum; and $\boldsymbol{v}$ is the resultant velocity of the earth.

And, therefore, the time difference, $\boldsymbol{\Delta t}$, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, conducted in the refracting medium of air, with the Fresnel coefficients being taken into consideration, can be obtained through the use of the following equation:

$$\Delta t = t_3 - t$$

where ***t*** is the total travel time, for the faster beam ***I***; and t_3 is the total travel time, for the slower beam ***II***.

It follows, therefore, that, in the case in which the Fresnel coefficients are being taken into account, the predicted numerical results, on the basis of assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, for a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude of ***7.2º S***, can be calculated, by inserting the following data:

$$c = 299792458 \ \ \mathrm{ms^{-1}}$$
$$v = 371000 \ \ \mathrm{ms^{-1}}$$
$$L = 32.000 \ \ \ \mathrm{m}$$
$$\mathrm{n} = 1.00029$$
$$0^{\circ} \leq \theta \leq 360^{o}$$

into this mathematical formula:

$$\Delta t = t_3 - t$$

where ***t*** is the the total time of flight, for the faster beam ***I***; and t_3 is the total time of flight, for the slower beam ***II***.

From the above equations, for calculating t, t_3, and ***Δt***, it's clear, at first glance, that, based on the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, for these two numerical values of ***θ***:

$$\theta = 90^{o}$$
$$\theta = 270^{o}$$

the computed numerical results, for the predicted time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, is equal to ***0***; i.e., no fringe-shift displacement, caused by Earth's velocity relative to the CMBR, can be observed, at the geographical latitude of ***7.2º S***, at the moment, in which the CMBR apex crosses the zenith, ***90º***, directly, overhead; or it crosses the nadir, ***270º***, directly above the antipodal side of the earth.

In addition, according to the same equations, for the following numerical value of ***θ***:

$$\theta = 0^{o}$$

the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam

II, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, has its first maximum value, in a repetition of the Mount-Wilson experiment, carried out in air, with the Fresnel coefficients being considered, anywhere at the geographical latitude of ***7.2º S***; i.e.,

$$\Delta t = t_3 - t = 7.25494 \times 10^{-17} \quad \text{s}$$

And, also, for this value of θ:

$$\theta = 180^o$$

the time difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic of light, has its second and slightly larger maximum value, for a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude of ***7.2º S***; i.e.,

$$\Delta t = t_3 - t = 1.16992 \times 10^{-16} \quad \text{s}$$

And therefore, at the geographical latitude of ***7.2º S***, all the computed numerical results, in accordance with the assumption of ballistic speed of light, for the predicted time difference, Δt, between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***, due to Earth's velocity relative to the CMBR, in any repetition of the Mount-Wilson experiment, conducted in the refracting medium of air, along with the Fresnel coefficients being taken into account, are within the following numerical range:

$$0 \le \Delta t \le 1.16992 \times 10^{-16} \quad \text{s}$$

in all cases, in which the Fresnel coefficients, in air, are being taken into consideration.

The results of the numerical difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in a repetition of the Mount-Wilson experiment, carried out in air, with the Fresnel coefficients being taken into consideration, anywhere at the geographical latitude of ***7.2º S***, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of θ, at the zenith side, are listed in **Table #*9***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	**6.696×10^{-17}**	**5.180×10^{-17}**	**3.167×10^{-17}**	**1.258×10^{-17}**	**5.971×10^{-19}**	**1.210×10^{-17}**	**3.480×10^{-17}**	**6.310×10^{-17}**	**9.028×10^{-17}**	**1.097×10^{-16}**

Table #9: ***Computed values of Δt at the zenith side***

And the computed results, for the numerical difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, at the same geographical latitude, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of θ, at the nadir side, are listed in **Table #*10***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**1.097x10^{-16}**	**9.028x10^{-17}**	**6.310x10^{-17}**	**3.480x10^{-17}**	**1.210x10^{-17}**	**5.971x10^{-19}**	**1.258x10^{-17}**	**3.167x10^{-17}**	**5.180x10^{-17}**	**6.696x10^{-17}**

Table #10*: Computed values of Δt at the nadir side*

Since the ratio between the maximum value for the predicted time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, has its maximum value, for a repetition of the Mount-Wilson experiment, in which the Fresnel coefficients, in air, are being taken into account, at the geographical latitude, ***7.2º S***:

$$\Delta t = 1.16992 \times 10^{-16} \quad \text{s}$$

and between the maximum value for the predicted time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the same assumption, has the following maximum value, for a repetition of the same experiment, at the same geographical latitude, and in which the Fresnel coefficients, in air, are being neglected:

$$\Delta t = 9.48258 \times 10^{-17} \quad \text{s}$$

that ratio is, relatively, small and equal to about ***1.23***, the effect of the Fresnel coefficients,on the calculated results for the Mount-Wilson experiment, is, somewhat, insignificant; and hence, those coefficients can, justifiably, be neglected, in any calculations, in accordance with the assumption of ballistic speed of light, at any geographical latitude, with regard to the experiment, under discussion.

7. Computed Results on the Assumption of Constant Speed of Light at 34.2264º N:

As mentioned earlier, in this discussion, the angle, ***34.2264º N***, is the geographical latitude of of Mount Wilson, California, on the summit of which Dayton C. Miller carried out his ether-drift experiment.

But due to the fact that the apex of Earth's velocity, relative to the CMBR, is at the equatorial declination, ***-7.2º***, the angle between the direction of the velocity of Earth, relative to CMBR, and the perpendicular line to the horizontal plane of the experimental apparatus, in the Mount-Wilson experiment, must be increased by ***7.2º***:

$$\delta + 7.2^o = 41.4264^o$$

where ***δ*** denotes the geographical latitude of the laboratory, at which the Mount-Wilson experiment is carried out.

And moreover, at every geographical latitude, except at the two geographical latitudes, ***7.2º S***, & ***82.8º N***, the vector of Earth's velocity, relative to the CMBR, is, at all times, composed of these two velocity components:

$$v\cos(\theta)\cos(\delta + 7.2^o)$$
$$v\sin(\delta + 7.2^o)$$

where δ is the geographical latitude of the laboratory; and θ is the angle of the instantaneous position of the CMBR apex, with respect to the meridian of the same laboratory, at which the Mount-Wilson is conducted.

Accordingly, the first velocity component: $v\cos(\theta)\cos(\delta + 7.2^o)$ varies, continuously, with the angle of the instantaneous position of the CMBR apex, θ; while the second velocity component: $v\sin(\delta + 7.2^o)$ remains constant, and, always, lies within the horizontal plane of the experimental apparatus, as well as within the horizontal plane of the slowly rotating interferometer, in the Mount-Wilson experiment.

Now, as demonstrated earlier, the derived equations, on the assumption of constant speed of light, as defined within the framework of the classical wave theory, in vacuum, in air with the Fresnel coefficients being neglected, and in air with the Fresnel coefficients being taken into account, give, virtually, the same numerical results, for the experiment under investigation.

And therefore, in order to simplify the calculations, on the assumption of constant speed of light, only the mathematical formulas, for light traveling in vacuum, will be employed, throughout the following discussion.

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** let θ denote the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let δ denote the angle of the geographical latitude of the laboratory, at which the Mount-Wilson experiment is carried out.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant, the magnitude of which can obtained by using the following equation:

$$\sqrt{\left[v\sin(\delta + 7.2^o)\right]^2 + \left[v\cos(\theta)\cos(\delta + 7.2^o)\right]^2} = v\sqrt{\sin^2(\delta + 7.2^o) + \cos^2(\theta)\cos^2(\delta + 7.2^o)}$$

where δ is the angle of the geographical latitude; θ is the angle of the instantaneous position of the CMBR apex; and v is the Earth's velocity, relative to the CMBR.

While the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant.

And, therefore, if the length of the horizontal path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{L + vt_1\sqrt{\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)}}{c} = \frac{L}{c - v\sqrt{\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)}}$$

where ***c*** is the speed of light, in vacuum; ***δ*** is the geographical latitude; and ***v*** is Earth's velocity, relative to the CMBR.

And likewise, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{L - vt_2\sqrt{\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)}}{c} = \frac{L}{c + v\sqrt{\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)}}$$

where ***L*** is the length of the light path.

And correspondingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{2L/c}{1 - \frac{v^2}{c^2}\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}$$

where ***c*** is the speed of light, in vacuum; ***v*** is the velocity of the earth, relative to the CMBR; ***δ*** is the geographical latitude; and ***θ*** is the instantaneous position of the CMBR apex.

And similarly, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to t_3:

$$t_3 = \frac{2\sqrt{L^2 + \left(\tfrac{1}{2}vt_3\right)^2\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}}{c} = \frac{2L/c}{\sqrt{1 - \frac{v^2}{c^2}\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}}$$

where ***c*** is the speed of light, in vacuum; and ***θ*** is the instantaneous position of the apex of the CMBR.

And, therefore, the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be calculated through the use of the following equation:

$$\Delta t = t - t_3 = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}}{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}\right)$$

where t is the total travel time, for the slower beam ***I***; and t_3 is the total travel time, for the faster beam ***II***.

It follows, therefore, that, at the geographical latitude of ***34.2264º N***, the predicted numerical results, for the Mount-Wilson experiment, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, can be calculated, by inserting the following data:

$$c = 299792458 \text{ m/s}$$
$$v = 371000 \text{ m/s}$$
$$L = 32.000 \text{ m}$$
$$\delta = 34.2264^o$$

into this mathematical formula:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}}{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}\right)$$

in which Δt is the time difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; L is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; v is Earth's velocity, with respect to the CMBR; and c is the speed of light, in vacuum.

And, subsequently, at the geographical latitude of ***34.2264º N***, during the time, in which the CMBR apex is either at the eastern horizon ($\theta = 0^o$), or at the western horizon of Mount Wilson ($\theta = 180^o$), the time difference, Δt, between the total time of flight, for the slower beam ***I***, and the total time of flight, for the faster beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, in the Mount-Wilson experiment, has the following maximum numerical value:

$$\Delta t = 1.63469 \times 10^{-13} \text{ sec.}$$

where ***Δt*** is the numerical difference between the total time of flight of the slower beam ***I***, and the total time of flight of the faster beam ***II***, due to Earth's velocity relative to the CMBR

And likewise, at the geographical latitude of ***34.2264º N***, when the CMBR apex is at its highest point in the sky — its transit altitude — on the zenith side; or, conversely, at its lowest point in the sky, on the nadir side, with respect to the meridian of Mount Wilson, the time difference, ***Δt***, between the time of flight, for the slower beam ***I***, and the time of flight, for the faster beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, in the Mount-Wilson experiment, can be computed, by inserting the above data, into this equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\sin^2\left(41.4264^o\right)}}{1-\frac{v^2}{c^2}\sin^2\left(41.4264^o\right)}\right)$$

where the following minimum numerical value can be obtained:

$$\Delta t = 7.15653 \times 10^{-14} \text{ sec.}$$

And therefore, at the geographical latitude of ***34.2264º N***, all of the calculated numerical results, on the basis of the assumption of constant speed of light, for the predicted difference, ***Δt***, between the total time of flight of the slower beam ***I***, and the total time of flight of the faster beam ***II***, due to Earth's velocity relative to the CMBR, in the Mount-Wilson experiment, are within this narrow numerical range:

$$7.15653 \times 10^{-14} \le \Delta t \le 1.63469 \times 10^{-13} \text{ sec.}$$

Furthermore, the daily variations, in the fringe-shift displacement, due to the changing direction of the CMBR apex, with respect to the meridian of the laboratory, at the geographical latitude of ***34.2264º N***, form a sinusoidal function, which repeats itself, every sidereal day, as illustrated in **Figure #5**, below:

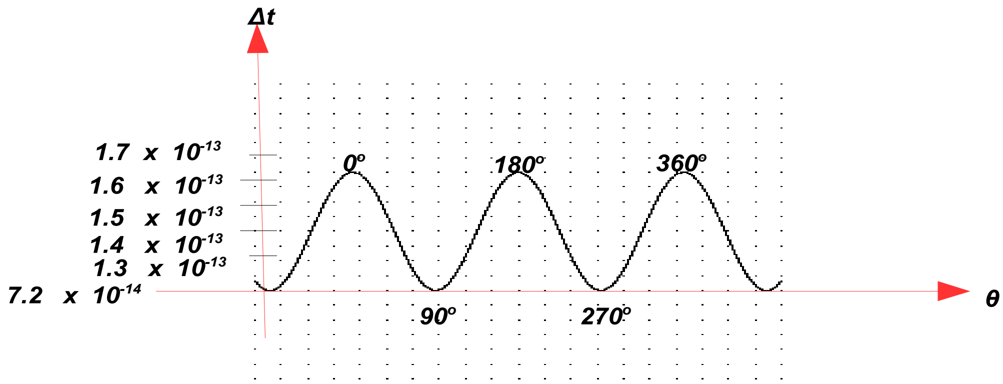

Figure #5: Daily fringe-shift variations at *34.2264º N*

It should be noticed, within the current context, that unlike at the geographical latitude ***7.2º S***, it's quite difficult, at the geographical latitude ***34.2264º N*** of Mount Wilson, to extract, from the raw experimental data, the daily sinusoidal variations, in the numerical values of the fringe-shift displacement, due to Earth's velocity, relative to the CMBR; and hence, a long series of experimental runs, over many months, along with the application of the methods of harmonic analysis, as Dayton C. Miller did, in the Mount-Wilson experiment, are, absolutely, necessary, in this regard.

The numerical results of the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the Mount-Wilson experiment, as predicted, at the geographical latitude of ***34.2264º N***, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*11***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	1.573×10^{-13}	1.405×10^{-13}	1.175×10^{-13}	9.454×10^{-14}	7.772×10^{-14}	7.772×10^{-14}	9.454×10^{-14}	1.175×10^{-13}	1.405×10^{-13}	1.573×10^{-13}

Table *#11*: *Computed values of Δt at the zenith side*

And, also, the computed results, for the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, as predicted, on the basis of the assumption of constant speed of light, at the geographical latitude of ***34.2264º N***, for a number of selected values of ***θ***, at the nadir side, are listed in **Table #*12***, below:

Θ deg.	195°	210°	225°	240°	255°	285°	300°	315°	330°	345°
Δt sec.	1.573x10^-13	1.405x10^-13	1.175x10^-13	9.454x10^-14	7.772x10^-14	7.772x10^-14	9.454x10^-14	1.175x10^-13	1.405x10^-14	1.573x10^-13

Table #12: *Computed values of Δt at the nadir side*

It has to be concluded, therefore, that, since, at the geographical latitude of ***34.2264º N***, all of the numerical values of the computed predictions, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, lie within this numerical range:

$$7.15653\times10^{-14} \le \Delta t \le 1.63469\times10^{-13} \ \text{ sec.}$$

where the lower limit of which is about ***600*** times greater than the reported experimental result of ***1.19 x 10⁻¹⁶ s***; those predicted results, in accordance with the assumption of constant speed of light, are, generally, inconsistent with the reported experimental result of ***1.19 x 10⁻¹⁶ s***; and, therefore, the attempt at devising a helper hypothesis, by Dayton C. Miller, to make the calculated results, on the theoretical assumption, under discussion, compatible with the obtained result of the Mount-Wilson experiment, is necessary and well justified.

8. Computed Results on the Assumption of Ballistic Speed of Light at 34.2264º N:

Since, as shown already, in the current investigation, the impact of the Fresnel coefficients on the computed numerical results, in accordance with the assumption of ballistic speed of light, in the case of the Mount-Wilson experiment, is insignificant and negligible, only the mathematical formulas, for light traveling in the refracting medium of air, with the Fresnel coefficients being neglected, will be employed, throughout this discussion.

Let the light source, ***S***, in the Mount-Wilson experiment, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** let ***θ*** denote the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let ***δ*** denote the angle of the geographical latitude of the laboratory.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant:

$$\sqrt{\left[v\sin\left(\delta+7.2^o\right)\right]^2+\left[v\cos\left(\theta\right)\cos\left(\delta+7.2^o\right)\right]^2}=v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}$$

where ***δ*** is the angle of the geographical latitude; ***θ*** is the angle of the instantaneous position of the CMBR apex; and $\boldsymbol{v}$ is the Earth's velocity, relative to the CMBR.

While the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And, accordingly, at the geographical latitude, the angle of which is equal to $\boldsymbol{\delta}$, if the length of the horizontal path is equal to ***L***, then the travel time of the beam ***I***, during the first part of its round trip, is equal to $\boldsymbol{t_1}$:

$$t_1=\frac{L+vt_1\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}{\dfrac{c+v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}{n}}=\frac{nL}{c-v\left(n-1\right)\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}$$

where $\boldsymbol{n}$ is the refractive index of air; $\boldsymbol{\theta}$ is the instantaneous position of the CMBR apex; $\boldsymbol{\delta}$ is the angle of the geographical latitude; and ***L*** is the length of the light path.

And in the same way, the travel time of the beam ***I***, during the second part of its round trip, is equal to $\boldsymbol{t_2}$:

$$t_2=\frac{L-vt_2\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}{\dfrac{c-v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}{n}}=\frac{nL}{c+v\left(n-1\right)\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}}$$

where ***L*** is the length of the light path.

And consequently, the total travel time of the beam ***I***, is equal to ***t***:

$$t=t_1+t_2=\frac{2nL/c}{1-\frac{v^2}{c^2}\left(n-1\right)^2\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}$$

where $\boldsymbol{c}$ is the muzzle speed of light, in vacuum; and $\boldsymbol{v}$ is the velocity of the earth, relative to the CMBR.

And similarly, if the length of the vertical path, in the Mount-Wilson experiment, is equal to ***L***, then the total travel time of the beam ***II***, is equal to $\boldsymbol{t_3}$:

$$t_3 = \frac{2\sqrt{L^2 + \left(\frac{1}{2} v t_3 \sqrt{\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}\right)^2}}{\sqrt{\frac{c^2}{n^2} + \frac{v^2\left[\sqrt{\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)}\right]^2}{n^2}}} = \frac{2nL/c}{\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}}$$

where **c** is the speed of light, in vacuum; and **θ** is the celestial altitude of the apex of the CMBR.

And, therefore, the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = t_3 - t = \frac{2nL}{c}\left(\frac{\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]\right) - \left(\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}\right)}{\left(\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}\right)\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]\right)}\right)$$

where **t** is the total travel time, for the faster beam ***I***; and $\boldsymbol{t_3}$ is the total travel time, for the slower beam ***II***.

It follows, therefore, that, at the geographical latitude of ***34.2264º N***, the predicted numerical results, for the Mount-Wilson experiment, on the basis of the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, can be calculated, by inserting the following numerical data:

$$c = 299792458 \ \text{ms}^{-1}$$
$$v = 371000 \ \text{ms}^{-1}$$
$$L = 32.000 \ \text{m}$$
$$n = 1.00029$$
$$\delta = 34.2264^o$$

into this mathematical formula:

$$\Delta t = \frac{2nL}{c}\left(\frac{\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]\right) - \left(\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}\right)}{\left(\sqrt{1 - \frac{v^2}{c^2}\left(n^2 - 1\right)\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]}\right)\left(1 - \frac{v^2}{c^2}\left(n-1\right)^2\left[\sin^2\left(\delta + 7.2^o\right) + \cos^2\left(\theta\right)\cos^2\left(\delta + 7.2^o\right)\right]\right)}\right)$$

in which ***Δt*** is the time difference between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***; **L** is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; $\boldsymbol{v}$ is Earth's velocity, with respect to the CMBR; and $\boldsymbol{c}$ is the muzzle speed of light, in vacuum.

And, subsequently, at the geographical latitude of ***34.2264º N***, when the CMBR apex is at the eastern horizon, or the western horizon of Mount Wilson, the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity, relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, in the Mount-Wilson experiment, has the following maximum numerical value:

$$\Delta t = 9.48258 \times 10^{-17} \ \text{ sec.}$$

where ***Δt*** is the numerical difference between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, due to Earth's velocity relative to the CMBR

And likewise, at the geographical latitude of ***34.2264º N***, when the CMBR apex is at its highest point in the sky ─ its transit altitude ─ on the zenith side; or, conversely, at its lowest point in the sky, on the nadir side, with respect to the meridian of Mount Wilson, the time difference, ***Δt***, between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, in the Mount-Wilson experiment, can be computed, by inserting the above data, into this equation:

$$\Delta t = \frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(41.4264^o\right)\right]\right)-\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(41.4264^o\right)\right]}\right)}{\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(41.4264^o\right)\right]}\right)\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(41.4264^o\right)\right]\right)}\right)$$

by the means of which the following minimum numerical value can be obtained:

$$\Delta t = 4.15138 \times 10^{-17} \ \text{ sec.}$$

And therefore, at the geographical latitude of ***34.2264º N***, all of the calculated numerical results, on the basis of the assumption of ballistic speed of light, for the predicted difference, ***Δt***, between the total time of flight of the faster beam ***I***, and the total time of flight of the slower beam ***II***, due to Earth's velocity relative to the CMBR, in the Mount-Wilson experiment, are within this narrow numerical range:

$$4.15138 \times 10^{-17} \le \Delta t \le 9.48258 \times 10^{-17} \ \text{ sec.}$$

Furthermore, the daily variations, in the fringe-shift displacement, due to the changing direction of the CMBR apex, with respect to the meridian of the laboratory, at the geographical latitude of ***34.2264º N***, form a sinusoidal function, which repeats itself, every sidereal day, as illustrated in **Figure #*6***, below:

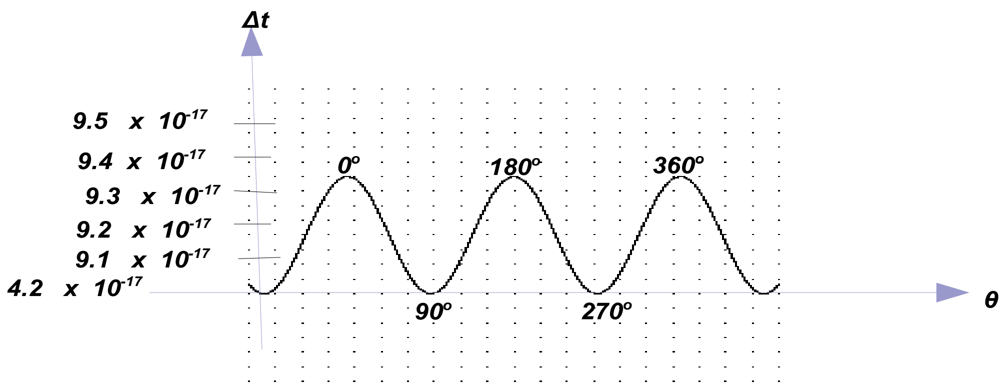

Figure #*6:* Daily fringe-shift variations at ***34.2264º N***

And subsequently, it can be concluded that, unlike at the geographical latitude ***7.2º S***, it's, undoubtedly, difficult, at the geographical latitude of ***34.2264º N*** of Mount Wilson, to spot, in the experimental data, the daily sinusoidal variations, in the fringe-shift displacement, due to Earth's motion relative to the CMBR; and hence, a long series of experimental runs, over many months, along with the application the methods of harmonic analysis, as Dayton C. Miller did, in the Mount-Wilson experiment, are required and necessary, in this regard.

The numerical results of the time difference, ***Δt***, between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***, due to Earth's velocity, relative to the CMBR, in the Mount-Wilson experiment, conducted in the refracting medium of air with the Fresnel coefficients being neglected, at the geographical latitude of ***34.2264º N***, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*13***, below:

Θ deg.	15º	30º	45º	60º	75º	105º	120º	135º	150º	165º
Δt sec.	9.125x10^{-17}	8.150x10^{-17}	6.817x10^{-17}	5.484x10^{-17}	4.509x10^{-17}	4.509x10^{-17}	54841x10^{-17}	6.817x10^{-17}	8.150x10^{-17}	9.125x10^{-17}

Table #*13*: *Computed values of Δt at the zenith side*

And the numerical results, for the computed time difference, ***Δt***, between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***, due to Earth's velocity, relative to the CMBR, in the same experiment, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of θ, at the nadir side, are listed in **Table #*14***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**9.125x10^{-17}**	**8.150x10^{-17}**	**6.817x10^{-17}**	**5.484x10^{-17}**	**4.509x10^{-17}**	**4.509x10^{-17}**	**5.484x10^{-17}**	**6.817x10^{-17}**	**8.150x10^{-17}**	**9.125x10^{-17}**

Table #*14*: *Computed values of Δt at the nadir side*

It can be concluded, therefore, that, at the geographical latitude of ***34.2264º N***, for values of θ, within these two numerical ranges:

$$0^o < \theta < 45^o$$

$$135^o < \theta < 180^o$$

on the zenith side;

as well as, for values of θ, within these two numerical ranges:

$$180^o < \theta < 225^o$$

$$315^o < \theta < 360^o$$

on the nadir side;

the computed results, in accordance with the assumption of ballistic speed of light, are consistent with the experimental result of $1.19 \times 10^{-16}\ s$, as reported by Dayton C. Miller, in his Mount-Wilson experiment.

While, at the same time, for values of θ, within the this numerical range:

$$45^o < \theta < 135^o$$

on the zenith side;

as well as, for values of θ, within this numerical range:

$$225^o < \theta < 315^o$$

on the nadir side;

the calculated results, on the basis of the assumption of ballistic speed of light, at the geographical latitude of ***34.2264º N***, tend to approach a minimum value of ***4.15138 x 10⁻¹⁷*** s, which is equal to about ***0.35*** times the reported experimental result of ***1.19 x 10⁻¹⁶ s***; and as a result, those computed numerical results become, increasingly, smaller and inconsistent with the reported result of the experiment, under discussion.

Nonetheless, the average numerical value of the above predictions, as computed on the assumption of ballistic speed of light, is equal to about ***6.81698 x 10⁻¹⁷*** s; i.e., about ***0.57*** times the reported experimental result of ***1.19 x 10⁻¹⁶ s***. And since the reported experimental result — itself — is the average numerical value of the measurements, obtained by Dayton C. Miller, in the Mount-Wilson experiment, the calculated predictions, in accordance with the assumption of ballistic speed of light, at the geographical latitude of ***34.2264º N***, are, generally, satisfactory and consistent with the aforementioned experimental finding.

9. The Numerical Values of Computed Predictions at 41.4993º N:

As pointed out earlier, the angle, ***+41.4993º***, is the geographical latitude of the site, in Cleveland, Ohio, at which Dayton C. Miller, as well as Albert A. Michelson and Edward W. Morley conducted their experiments.

In the present section, the predicted results, for a repetition of the Mount-Wilson experiment, at the geographical latitude of ***41.4993ºN***, will be calculated, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, and on the basis of the assumption of ballistic speed of light, as defined with the framework of the elastic-impact emission theory, respectively.

A. The computed results on the assumption of constant speed of light:

Let the light source, ***S***, in the Mount-Wilson experiment, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** let θ stand for the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let δ denote the angle of the geographical latitude of the laboratory.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant:

$$\sqrt{\left[v\sin\left(\delta+7.2^o\right)\right]^2+\left[v\cos(\theta)\cos\left(\delta+7.2^o\right)\right]^2}=v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)}$$

where δ is the angle of the geographical latitude; θ is the angle of the instantaneous position of the CMBR apex; and v is the Earth's velocity, relative to the CMBR.

And at the same time, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And therefore, the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}}{1-\frac{v^2}{c^2}\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}\right)$$

where Δt is the time difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the method of the multiple-reflections; ***v*** is Earth's velocity, with respect to the CMBR; and ***c*** is the speed of light, in vacuum.

Accordingly, at the geographical latitude of ***41.4993º N***, the predicted numerical results, for the Mount-Wilson experiment, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, can be obtained, by inserting the following numerical data:

$$c = 299792458 \ \text{ ms}^{-1}$$
$$v = 371000 \ \text{ ms}^{-1}$$
$$L = 32.000 \ \text{ m}$$
$$\delta = +41.4993^o$$

into the above mathematical formula.

And, therefore, when the CMBR apex is at the eastern horizon — $\theta = 0^o$ — or the western horizon — $\theta = 180^o$ — of Cleveland, OH, the time difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, in the Mount-Wilson experiment, has the following maximum numerical value:

$$\Delta t = 1.63469 \times 10^{-13} \ \text{ sec.}$$

where Δt is the numerical difference between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, due to Earth's velocity relative to the CMBR

And likewise, when the CMBR apex is at its highest point in the sky — its transit altitude — on the zenith side; or, conversely, at its lowest point in the sky, on the nadir side, with respect to the meridian of Cleveland, OH, the time difference, Δt, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity, relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, in the Mount-Wilson experiment, can be computed, by inserting the above numerical data, into this equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^2}{c^2}\sin^2\left(48.6993^o\right)}}{1-\frac{v^2}{c^2}\sin^2\left(48.6993^o\right)}\right)$$

where the following minimum numerical value can be obtained:

$$\Delta t = 9.22597 \times 10^{-14} \text{ sec.}$$

And therefore, at the geographical latitude of ***41.4993º N***, all of the calculated numerical results, in accordance with the assumption of constant speed of light, for the predicted difference, ***Δt***, between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, due to Earth's velocity, relative to the CMBR, in the Mount-Wilson experiment, are within the following numerical range:

$$9.22597 \times 10^{-14} \le \Delta t \le 1.63469 \times 10^{-13} \text{ s}$$

which is, relatively, much narrower than the numerical range, for the predicted numerical results:

$$7.15653 \times 10^{-14} \le \Delta t \le 1.63469 \times 10^{-13} \text{ sec.}$$

at the geographical latitude of Mount Wilson; and hence, it's much more difficult, at the geographical latitude of Cleveland, OH, to detect, in the experimental data, the diurnal sinusoidal variations, in the fringe-shift displacement, due to Earth's motion relative to the CMBR.

The calculated results of the numerical difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the Mount-Wilson experiment, conducted at the geographical latitude of ***41.4993º N***, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*15***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	**1.587x10^-13^**	**1.457x10^-13^**	**1.279x10^-13^**	**1.101x10^-13^**	**9.703x10^-14^**	**9.703x10^-14^**	**1.101x10^-13^**	**1.279x10^-13^**	**1.457x10^-13^**	**1.587x10^-13^**

Table #*15*: *Computed values of Δt at the zenith side*

And the computed results, for the numerical difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion relative to the CMBR, in the same experiment, carried out at the same geographical latitude, as predicted, on the basis of the assumption of constant speed of light, for a number of selected values of ***θ***, at the nadir side, are listed in **Table *#16***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**$1.587x10^{-13}$**	**$1.457x10^{-13}$**	**$1.279x10^{-13}$**	**$1.101x10^{-13}$**	**$9.703x10^{-14}$**	**$9.703x10^{-14}$**	**$1.101x10^{-13}$**	**$1.279x10^{-13}$**	**$1.457x10^{-14}$**	**$1.587x10^{-13}$**

Table *#16: Computed values of Δt at the nadir side*

It should be concluded, therefore, that, since, at the geographical latitude of ***41.4993º N***, the calculated numerical results, on the basis of the assumption of constant speed of light, fall within this numerical range:

$$9.22597 \times 10^{-14} \leq \Delta t \leq 1.63469 \times 10^{-13} \text{ sec.}$$

the lower limit of which is about ***775*** times greater than ***$1.19 x 10^{-16}$ s***; those predicted results, on the assumption of constant speed of light, as defined within the framework of the classical waves theory,, are, widely, inconsistent with the reported experimental result of ***$1.19 x 10^{-16}$ s***; and that the attempt at devising a helper hypothesis, by Dayton C. Miller, to make the computed results on the theoretical assumption, under discussion, compatible with the obtained result of the Mount-Wilson experiment, is necessary and justified.

And, finally, at the geographical latitude of Cleveland, OH, let's replace the ***64***-meter light path, in Dayton C. Miller's Mount-Wilson experiment, with the ***22-***meter light path, in the Michelson-Morley experiment.

Based on the assumption of constant speed of light, the reported result of ***$1.19 x 10^{-16}$ s***, in the Mount-Wilson experiment, has to be scaled down by a factor of ***0.34375*** [***Ref. #11***]; i.e.,

$$\frac{22}{64}\left[1.19 \times 10^{-16}\right] = 4.090625 \times 10^{-17} \text{ sec.}$$

But, at the same time, the numerical range, for the predicted results, on the basis of the assumption of constant speed of light, must be scaled down by the same factor, as well; i.e.,

$$3.17143 \times 10^{-14} \leq \Delta t \leq 5.61925 \times 10^{-14} \text{ sec.}$$

in which the reduced lower limit is still ***775*** times larger than the reduced experimental result.

B. The computed results on the assumption of ballistic speed of light:

For a repetition of the Mount-Wilson experiment, carried out in vacuum, at any geographical latitude, the predicted result, in accordance with the assumption of ballistic speed of light, is, always, nil.

And consequently, only a repetition of the aforementioned experiment, conducted in the refracting medium of air, at the geographical latitude of ***41.4993º N***, is investigated and discussed, at length, in this section.

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** let θ stand for the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let δ denote the angle of the geographical latitude of the laboratory, at which a repetition of the Mount-Wilson experiment, is carried out.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant, ***v***, relative to the CMBR:

$$\sqrt{\left[v\sin\left(\delta+7.2^o\right)\right]^2+\left[v\cos\left(\theta\right)\cos\left(\delta+7.2^o\right)\right]^2}=v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)}$$

where δ is the angle of the geographical latitude; θ is the angle of the instantaneous position of the CMBR apex; and ***v*** is the Earth's velocity, relative to the CMBR frame of reference.

While the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant, ***v.***

And it follows, therefore, that, according to the assumption of ballistic speed of light, the numerical difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, at any geographical latitude, can be obtained through the use of the following equation:

$$\Delta t=\frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]\right)-\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}\right)}{\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]}\right)\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(\delta+7.2^o\right)+\cos^2\left(\theta\right)\cos^2\left(\delta+7.2^o\right)\right]\right)}\right)$$

where Δt is the difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection method; ***v*** is Earth's velocity, with respect to the CMBR; ***n*** is the refractive index of air; and ***c*** is the muzzle speed of light, in vacuum.

At the geographical latitude of ***41.4993º N***, therefore, the predicted numerical results, for a repetition of the Mount-Wilson experiment, on the basis of the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, can be calculated, by inserting the following numerical data:

$$c = 299792458 \ \ \text{ms}^{-1}$$
$$v = 371000 \ \ \text{ms}^{-1}$$
$$L = 32.000 \ \ \text{m}$$
$$n = 1.00029$$
$$\delta = 41.4993^{o}$$

into the above mathematical formula.

And, correspondingly, when the CMBR apex is at the eastern horizon — ***θ = 0º*** — or the western horizon — ***θ = 180º*** — of Cleveland, OH, the time difference, ***Δt***, between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, in the Mount-Wilson experiment, has the following maximum numerical value:

$$\Delta t = 9.48258 \times 10^{-17} \ \ \text{sec.}$$

where ***Δt*** is the numerical difference between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, due to Earth's velocity, relative to the CMBR.

And likewise, at the geographical latitude of ***41.4993º N***, when the CMBR apex is at its highest point in the sky ─ its transit altitude ─ on the zenith side; or, conversely, at its lowest point in the sky, on the nadir side, with respect to the meridian of Cleveland, OH, the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, in the Mount-Wilson experiment, can be computed, by inserting the above numerical data, into this equation:

$$\Delta t = \frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(41.4264^{o}\right)\right]\right)-\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(41.4264^{o}\right)\right]}\right)}{\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(41.4264^{o}\right)\right]}\right)\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(41.4264^{o}\right)\right]\right)}\right)$$

where the following minimum numerical value can be obtained:

$$\Delta t = 5.35183 \times 10^{-17} \ \ \text{sec.}$$

And therefore, at the geographical latitude of ***41.4993º N***, all of the calculated numerical results, on the basis of the assumption of ballistic speed of light, for the predicted difference, ***Δt***, between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, due to Earth's velocity, relative to the CMBR, in the Mount-Wilson experiment, are within this narrow numerical range:

$$5.35183\times10^{-17} \le \Delta t \le 9.48258\times10^{-17} \text{ sec.}$$

and from which it can be concluded, at once, that unlike at the geographical latitude ***7.2º S***, it's quite difficult, at the geographical latitude ***41.4993º N*** of Cleveland, OH, to spot, in the experimental data, the daily sinusoidal variations, in the fringe-shift displacement, due to Earth's motion, relative to the CMBR; and hence, a long series of experimental runs, over many months, along with the application the methods of harmonic analysis, as Dayton C. Miller did, in the Mount-Wilson experiment, must be carried out, in this regard.

The numerical results of the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's velocity, with respect to the Cosmic Microwave Background Radiation, in the Mount-Wilson experiment, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of ***θ***, at the zenith side, are listed in **Table #*17***, below:

Θ deg.	**15º**	**30º**	**45º**	**60º**	**75º**	**105º**	**120º**	**135º**	**150º**	**165º**
Δt sec.	**9.206x10⁻¹⁷**	**8.450x10⁻¹⁷**	**7.417x10⁻¹⁷**	**6.385x10⁻¹⁷**	**5.629x10⁻¹⁷**	**5.629x10⁻¹⁷**	**6.385x10⁻¹⁷**	**7.417x10⁻¹⁷**	**8.450x10⁻¹⁷**	**9.206x10⁻¹⁷**

Table #*17*: *Computed values of Δt at the zenith side*

And the computed results, for the time difference, ***Δt***, between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***, due to Earth's motion, relative to the CMBR, in the same experiment, at the same geographical latitude, as predicted, on the basis of the assumption of ballistic speed of light, for a number of selected values of ***θ***, at the nadir side, are listed in **Table #*18***, below:

Θ deg.	**195º**	**210º**	**225º**	**240º**	**255º**	**285º**	**300º**	**315º**	**330º**	**345º**
Δt sec.	**9.206x10⁻¹⁷**	**8.450x10⁻¹⁷**	**7.417x10⁻¹⁷**	**6.385x10⁻¹⁷**	**5.629x10⁻¹⁷**	**5.629x10⁻¹⁷**	**6.385x10⁻¹⁷**	**7.417x10⁻¹⁷**	**8.450x10⁻¹⁷**	**9.206x10⁻¹⁷**

Table #*18*: *Computed values of Δt at the nadir side*

We have to conclude, therefore, that, since the computed results, on the basis of the assumption of ballistic speed of light, at the geographical latitude of ***41.4993º N***, are within this numerical range:

$$5.35183\times10^{-17} \le \Delta t \le 9.48258\times10^{-17} \text{ sec.}$$

and in which the lower limit of which is about ***0.45*** times the measured numerical value of ***1.19×10^{-16} s***; the above calculated results, on the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, are, generality, close to the reported result of the Mount-Wilson experiment, as measured by Dayton C. Miller, farther south, at the geographical latitude of ***34.4264º N***, on the summit of Mount Wilson.

And, finally, let's, at the geographical latitude of Cleveland, OH, replace the ***64***-meter light path, in Dayton C. Miller's Mount-Wilson experiment, with the ***22-***meter light path, in the Michelson-Morley experiment.

According to the assumption of ballistic speed of light, the experimental result of 1.19×10^{-16} ***s***, reported by Dayton C. Miller, must be reduced by a factor of ***11/32*** [***Ref. #11***]; i.e.,

$$\frac{22}{64}\left[1.19\times10^{-16}\right]=4.090625\times10^{-17}\ \ \text{sec.}$$

And, at the same time, the numerical range, for the computed predictions, on the basis of the assumption of ballistic speed of light, must be reduced, by the same factor, as well; i.e.,

$$1.83969\times10^{-17}\leq\Delta t\leq3.25964\times10^{-17}\ \ \text{sec.}$$

in which the reduced lower limit is still ***0.45*** times the reduced experimental result.

10. The Numerical Results of Computed Predictions at 82.8^o N:

At the geographical latitude of ***82.8^o N***, the instantaneous position of the apex of Earth's velocity, relative to the CMBR, θ, coincides, always, with the horizon of the laboratory, at which a repetition of the Mount-Wilson experiment is carried out.

And consequently, at the geographical latitude of ***82.8^o N***, the velocity vector of Earth, with respect to the CMBR, remains within the horizontal plane of the interferometer, in the Mount-Wilson experiment, at all times.

Moreover, due to the rotation of the earth, around its geometrical axis, a stationary interferometer, at the geographical latitude of ***82.8^o N***, makes one rotation of ***360^o***, around its geometrical center, every ***23*** hours, ***56*** minutes, and ***4.1*** seconds, with respect to the stars.

In this section, the predicted results, for a repetition of the Mount-Wilson experiment, at the geographical latitude of ***82.8^o N***, will be computed, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, and on the basis of the assumption of ballistic speed of light, as defined with the framework of the elastic-impact emission theory, respectively.

I. **The computed results on the assumption of constant speed of light:**

Let the light source, ***S***, in a repetition of the Mount-Wilson experiment, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** let θ stand for the angle of the instantaneous position angle of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let δ denote the angle of the geographical latitude of the laboratory.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant:

$$\sqrt{\left[v\sin\left(\delta+7.2^{o}\right)\right]^{2}+\left[v\cos\left(\theta\right)\cos\left(\delta+7.2^{o}\right)\right]^{2}}=v\sqrt{\sin^{2}\left(\delta+7.2^{o}\right)+\cos^{2}\left(\theta\right)\cos^{2}\left(\delta+7.2^{o}\right)}$$

where $\boldsymbol{\delta}$ is the angle of the geographical latitude; $\boldsymbol{\theta}$ is the angle of the instantaneous position of the CMBR apex; and $\boldsymbol{v}$ is the Earth's velocity, relative to the CMBR frame of reference.

And therefore, at any geographical latitude, the numerical difference, between the total travel time of the slower beam ***I***, and the total travel time of the faster beam ***II***, in the Mount-Wilson experiment, can be computed, on the basis of the assumption of constant speed of light, through the use of the following equation:

$$\Delta t=\frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^{2}}{c^{2}}\left[\sin^{2}\left(\delta+7.2^{o}\right)+\cos^{2}\left(\theta\right)\cos^{2}\left(\delta+7.2^{o}\right)\right]}}{1-\frac{v^{2}}{c^{2}}\left[\sin^{2}\left(\delta+7.2^{o}\right)+\cos^{2}\left(\theta\right)\cos^{2}\left(\delta+7.2^{o}\right)\right]}\right)$$

where $\boldsymbol{\Delta t}$ is the numerical difference between the total time of flight, for the beam ***I***, and the total time of flight, for the beam ***II***; $\boldsymbol{L}$ is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; $\boldsymbol{v}$ is Earth's velocity, with respect to the CMBR; and $\boldsymbol{c}$ is the speed of light, in vacuum.

And since, at the geographical latitude of ***82.8º N***, $\boldsymbol{\delta}$ is equal to ***82.8º***; i.e.,

$$\delta+7.2^{o}=90^{o}$$

the above equation is reduced to this much simpler equation:

$$\Delta t=\frac{2L}{c}\left(\frac{1-\sqrt{1-\frac{v^{2}}{c^{2}}}}{1-\frac{v^{2}}{c^{2}}}\right)$$

where $\boldsymbol{\Delta t}$ is the time difference between the total travel time of the slower beam ***I***, and the total travel time of the faster beam ***II***.

It should be clear, therefore, that no diurnal variations, in the fringe-shift displacement, due to the motion of the earth, with respect to the CMBR, can be measured, by the means of Dayton C. Miller's experimental apparatus, anywhere, along the geographical latitude of ***82.8º N***.

Nonetheless, in the case, in which the Dayton C. Miller's experimental apparatus is left at rest, the two arms of its interferometer must rotate by ***90º***, and exchange their spatial orientation, relative to the apex of the CMBR, with each other, every ***5*** hours, ***59*** minutes, and ***1.025*** seconds; i.e., the horizontal beam ***I***, in the Mount-Wilson experiment, becomes transverse; while the transverse beam ***II*** becomes horizontal; and vice versa.

And, as a mater of fact, the aforementioned sort of beam switching is equivalent, in every respect, to the exact experimental technique that has been employed by Albert A. Michelson, Edward W. Morley, and Dayton C. Miller, for comparing the measurements from the two spatial orientations, and for doubling the total time difference ***Δt***, along with the amount of fringe-shift displacement, in each experimental run.

It follows, therefore, that the predicted numerical result, for a repetition of the Mount-Wilson experiment, at the geographical latitude of ***82.8º N***, as computed in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory, can be obtained by plugging the following data:

$$c = 299792458 \ \ \mathrm{ms^{-1}}$$
$$v = 371000 \ \ \mathrm{ms^{-1}}$$
$$L = 32.000 \ \ \mathrm{m}$$

into the above mathematical formula.

And accordingly, the time difference, ***Δt***, between the total time of flight, for the slower beam ***I***, and the total time of flight, for the faster beam ***II***, due to Earth's velocity, relative to the CMBR, as predicted on the basis of the assumption of constant speed of light, in each run of a repetition of the Mount-Wilson experiment, conducted at the geographical latitude of ***82.8º N***, has this one single numerical value:

$$\Delta t = 1.63469 \times 10^{-13} \ \ \mathrm{sec.}$$

where ***Δt*** is the numerical difference between the total travel time of the slower beam ***I***, and the total travel time of the faster beam ***II***, due to Earth's velocity relative to the CMBR

II. **The computed results on the assumption of ballistic speed of light:**

It should be taken into account, within this context, that, according to the assumption of ballistic speed of light, the predicted numerical result, in the case of a repetition of the Mount-Wilson experiment, carried out in vacuum, at any geographical latitude, is, always, equal to zero.

And therefore, only a repetition of the experiment, under discussion, conducted in the refracting medium of air, will be treated, in detail, here, in accordance with the above assumption.

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** let θ denote the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; and let δ stand for the angle of the geographical latitude of the laboratory, at which a repetition of the Mount-Wilson experiment is carried out.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity resultant, ***v***:

$$\sqrt{\left[v\sin\left(\delta+7.2^o\right)\right]^2+\left[v\cos(\theta)\cos\left(\delta+7.2^o\right)\right]^2}=v\sqrt{\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)}$$

where δ is the angle of the geographical latitude; θ is the angle of the instantaneous position of the CMBR apex; and ***v*** is the Earth's velocity, relative to the CMBR frame of reference.

And therefore, according to the assumption of ballistic speed of light, the numerical difference, between the total travel of the faster beam ***I***, and the total travel time of the slower beam ***II***, in any repetition of the Mount-Wilson experiment, carried out in the refracting medium of air, at any geographical latitude, can be obtained through the use of the following equation:

$$\Delta t=\frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)\right]\right)-\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)\right]}\right)}{\left(\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)\left[\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)\right]}\right)\left(1-\frac{v^2}{c^2}(n-1)^2\left[\sin^2\left(\delta+7.2^o\right)+\cos^2(\theta)\cos^2\left(\delta+7.2^o\right)\right]\right)}\right)$$

where Δt is the difference between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the method of the multiple-reflections; ***v*** is Earth's velocity, with respect to the CMBR; ***n*** is the refractive index; and ***c*** is the muzzle speed of light, in vacuum.

And since, at the geographical latitude of ***82.8º N***, δ is equal to ***82.8º***:

$$\delta+7.2^o=90^o$$

the above equation takes this much simpler form:

$$\Delta t = \frac{2nL}{c}\left(\frac{\left(1-\frac{v^2}{c^2}(n-1)^2\right)-\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}}{\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}\left(1-\frac{v^2}{c^2}(n-1)^2\right)}\right)$$

where ***Δt*** is the numerical difference between the total travel time of the faster beam ***I***, and the total travel time of the slower beam ***II***.

It should be noted, therefore, that no diurnal variations, in the fringe-shift displacement, caused by the motion of the earth, with respect to the CMBR, can be measured, by the means of Dayton C. Miller's experimental apparatus, at the geographical latitude of ***82.8º N***.

However, in the case, in which the Dayton C. Miller's experimental apparatus is left at rest, the two arms of its interferometer must rotate by ***90º***, and exchange their spatial orientation, relative to the apex of the CMBR, with each other, every ***5*** hours, ***59*** minutes, and ***1.025*** seconds; i.e., the faster horizontal beam ***I***, in the Mount-Wilson experiment, becomes transverse and slower; while the slower transverse beam ***II*** becomes horizontal and faster; and vice versa.

Nonetheless, the above sort of beam switching is equivalent, in every respect, to the same experimental technique, used by Albert A. Michelson, Edward W. Morley, and Dayton C. Miller, for comparing the measurements from the two spatial orientations, and doubling the total time difference ***Δt***, along with the amount of fringe-shift displacement, in each experimental run.

It follows, therefore, that, according to the assumption of ballistic speed of light, the predicted numerical results, for a repetition of the Mount-Wilson experiment, conducted int the refracting medium of air, at the geographical latitude of ***82.8º N***, can be obtained by plugging the following numerical data:

$$c = 299792458 \text{ ms}^{-1}$$
$$v = 371000 \text{ ms}^{-1}$$
$$L = 32.000 \text{ m}$$
$$n = 1.00029$$

into the above mathematical formula.

And accordingly, the time difference, ***Δt***, between the total time of flight, for the faster beam ***I***, and the total time of flight, for the slower beam ***II***, due to Earth's velocity relative to the CMBR, as predicted on the basis of the assumption of ballistic speed of light, in a repetition of the Mount-Wilson experiment, carried out in air, at the geographical latitude of ***82.8º N***, has this one single numerical value:

$$\Delta t = 9.48258 \times 10^{-17} \text{ sec.}$$

where ***Δt*** is the numerical difference between the time of flight of the faster beam ***I***, and the time of flight of the slower beam ***II***, due to Earth's velocity, relative to the CMBR.

11. Fringe-shift Variations Due to Earth's Orbital Motion Around the Sun:

As mentioned earlier, in this discussion, the apex of Earth's velocity, relative to the Cosmic Microwave Background Radiation (CMBR), is specified and well-defined by the following observational data:

$$v = 370600 \pm 400 \ \text{ms}^{-1}$$
$$l = 264.31^o \pm 0.17^o, \quad b = 48.05^o \pm 0.10^o$$
$$RA = 11:12:00, \quad Dec = -7.20^o$$

where ***v*** is the velocity of Earth, relative to the CMBR; ***l*** is the galactic longitude; ***b*** is the galactic latitude; ***RA*** is the right ascension; and ***Dec*** is the equatorial declination.

However, due to the fact that Earth is, also, moving, around the gravitational center of the solar system, with a mean orbital velocity of ***29780*** m/s, the alignment between Earth's velocity, relative to the CMBR, and Earth's orbital velocity, around the gravitational center of the solar system, must vary, constantly, throughout the year, as illustrated in **Figure #*7***, below:

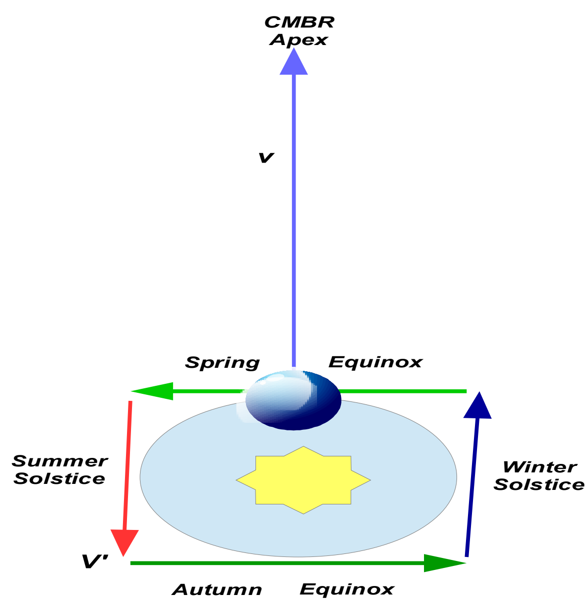

Figure #*7:* Seasonal fringe-shift variations

Furthermore, Earth's velocity, relative to the CMBR, makes an angle of about ***11.1º*** with the plane of Earth's orbit, around the gravitational center of the solar system; i.e.,. the ecliptic.

And it follows, therefore, that the major annual alignments between Earth's velocity, relative to the CMBR, ***v***, and Earth's orbital velocity, around the gravitational center of the solar system, ***v′***, can be summarized in the following list:

1. When Earth is at RA: ***5ʰ 12ᵐ*** — about ***12*** days before the winter solstice — Earth's orbital velocity, around the gravitational center of the solar system, ***v′***, is pointing in the same direction as that of Earth's velocity, relative to the CMBR, ***v***; and therefore:

$$@RA = 5^h\ 12^m :$$
$$\sqrt{\left[v + v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

2. When Earth is at RA: ***11ʰ 12ᵐ*** — about ***12*** days before the vernal equinox — Earth's orbital velocity, around the gravitational center of the solar system, ***v′***, is at right angles to Earth's velocity, relative to the CMBR, ***v***; i.e.,

$$@RA = 11^h\ 12^m :$$
$$\sqrt{v^2 + v'^2}$$

3. When Earth is at RA: ***17ʰ 12ᵐ*** — about ***12*** days before the summer solstice — Earth's orbital velocity, around the gravitational center of the solar system, ***v′***, is pointing in the opposite direction to that of the Earth's velocity, relative to the CMBR, ***v***; i.e.,

$$@RA = 17^h\ 12^m :$$
$$\sqrt{\left[v - v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

4. When Earth is at RA: ***23ʰ 12ᵐ*** — about ***12*** days before the autumnal equinox — Earth's orbital velocity, around the gravitational center of the solar system, ***v′***, is at right angles to Earth's velocity, relative to the CMBR, ***v***; i.e.,

$$@\, RA = 23^h\ \ 12^m:$$
$$\sqrt{v^2 + v'^2}$$

where v is the velocity of Earth, relative to CMBR; and v' is the orbital velocity of Earth, around the barycenter of the solar system.

It should be pointed out, within the current context, that, because of the relatively higher geographical latitude of Mount Wilson, the annual variations, in the fringe-shift displacement, dominate the measurements, and constitute, the large part of the raw data, gathered, by Dayton C. Miller, on the summit of that mountain.

In this section, the numerical values of the annual variations, in the fringe-shift displacement, in the Mount-Wilson experiment, at the geographical latitude of ***7.2º S***, and at the geographical latitude of ***34.2264º N***, will be computed, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory, as well as, in accordance with the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, respectively.

A. Annual Fringe-shift variations according to the assumption of constant speed of light:

According to the assumption of constant speed of light, both the maximum value and the minimum value, for the annual variations, in the fringe-shift displacement, remain constant and the same, at all geographical latitudes;. but, at the same time, all other values, between the maximum value and the minimum value, vary with the values of the angle ($\delta + 7.2^o$).

Let the light source, ***S***, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** let θ denote the angle of the instantaneous position of the apex of Earth's velocity, ***v***, relative to the CMBR, with respect to the meridian of the laboratory; v' is the mean orbital velocity of Earth, around the barycenter of the solar system; and let δ stand for the angle of the geographical latitude of the laboratory.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus:

1. At the geographical latitude ***7.2º S***:

   The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the maximum velocity resultant:

$$\sqrt{\left[v + v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

   when Earth is at RA = $5^h\ 12^m$;

   and in the direction of the minimum velocity resultant:

$$\sqrt{\left[v - v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***17^h^ 12^m^***.

While, in both cases, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And therefore, the annual maximum difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, at the geographical latitude of ***7.2º S***, can be computed, on the basis of the assumption of constant speed of light, as defined within the framework of the classical wave theory, by using this equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\dfrac{\left[v+v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}}{1-\dfrac{\left[v+v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}\right)$$

And, at the same time, the annual minimum difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the same repetition of the Mount-Wilson experiment, at the same geographical latitude, can be computed, in accordance with the same assumption of constant speed of light, through the use of the following equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1-\sqrt{1-\dfrac{\left[v-v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}}{1-\dfrac{\left[v-v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}\right)$$

where ***Δt*** is the numerical difference between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection method; ***v*** is Earth's velocity, with respect to the CMBR; ***v'*** is the orbital velocity of Earth, around the gravitational center of the solar system; and ***c*** is the speed of light, in vacuum.

And it follows, therefore, that, by interesting, into the above two formulas, respectively, the following observational data:

$$c = 299792458 \ \ \text{ms}^{-1}$$
$$v = 371000 \ \ \text{ms}^{-1}$$
$$v' = 29780 \ \ \text{ms}^{-1}$$
$$L = 32.000 \ \ \text{m}$$

the annual maximum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***7.2 S***, as computed, for a repetition of the Mount-Wilson experiment, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory, is equal to this numerical value, Δt_{max}:

$$\Delta t_{\max} = 1.90275 \times 10^{-13} \ \ \text{sec.}$$

And likewise, the annual minimum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***7.2 S***, as computed, for the same repetition of the Mount-Wilson experiment, on the basis of the assumption of constant speed of light, as defined within the context of the classical wave theory, is equal to this numerical value, Δt_{min}:

$$\Delta t_{\min} = 1.38770 \times 10^{-13} \ \ \text{sec.}$$

And correspondingly, the predicted values of the fringe-shift displacement, as calculated on the basis of the assumption of constant speed of light, vary, annually, due to Earth's orbital motion, around the gravitational center of the solar system, within this numerical range:

$$1.38770 \times 10^{-13} \le \Delta t \le 1.90275 \times 10^{-13} \ \ \text{sec.}$$

in which the upper limit is about ***1.37*** times greater than the lower limit.

2. At the geographical latitude of Mount Wilson, 34.2264^o ***N***:

As already pointed out, the maximum and the minimum values, for the annual variations, in the fringe-shift displacement, are the same, at all geographical latitudes, because the maximum and the minimum velocity resultants are equal and the same, at all geographical latitudes.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the maximum velocity resultant:

$$\sqrt{\left[v + v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = $5^h\ 12^m$;

and in the direction of the minimum velocity resultant:

$$\sqrt{\left[v - v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***17^h^ 12^m^***.

While, in both cases, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And therefore, at the geographical latitude of ***34.2264^o^ N***, the annual maximum difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be computed, in accordance with the assumption of constant speed of light, through the use of the following equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1 - \sqrt{1 - \frac{\left[v + v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}}{1 - \frac{\left[v + v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}\right)$$

While the annual minimum difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be computed, in accordance with the assumption of constant speed of light, through the use of the following equation:

$$\Delta t = \frac{2L}{c}\left(\frac{1 - \sqrt{1 - \frac{\left[v - v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}}{1 - \frac{\left[v - v'\cos\left(11.1^o\right)\right]^2 + v'^2\sin^2\left(11.1^o\right)}{c^2}}\right)$$

where ***Δt*** is the difference between the time of flight, for the beam ***I***, and the time of flight, for the beam ***II***; ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; ***v*** is Earth's velocity, with respect to the CMBR; and ***c*** is the speed of light, in vacuum.

And it follows, therefore, that, by interesting, into the above two formulas, respectively, the following observational data:

$$c = 299792458 \ \ \text{ms}^{-1}$$
$$v = 371000 \ \ \text{ms}^{-1}$$
$$v' = 29780 \ \ \text{ms}^{-1}$$
$$L = 32.000 \ \ \text{m}$$

the annual maximum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***34.2264º N***, as calculated, for the Mount-Wilson experiment, on the basis of the assumption of constant speed of light, is equal to this numerical value, Δt_{max}:

$$\Delta t_{\max} = 1.90275 \times 10^{-13} \ \ \text{sec.}$$

And similarly, the annual minimum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***34.2264º N***, as computed, for the Mount-Wilson experiment, in accordance with the assumption of constant speed of light, is equal to this numerical value, Δt_{min}:

$$\Delta t_{\min} = 1.38770 \times 10^{-13} \ \ \text{sec.}$$

And correspondingly, at the geographical latitude of ***34.2264º N***, the predicted values of the fringe-shift displacement, as calculated on the basis of the assumption of constant speed of light, vary, annually, due to Earth's orbital motion, around the gravitational center of the solar system, within this numerical range:

$$1.38770 \times 10^{-13} \le \Delta t \le 1.90275 \times 10^{-13} \ \ \text{sec.}$$

in which the upper limit is about ***1.37*** times greater than the lower limit.

B. Annual Fringe-shift variations on the assumption of ballistic speed of light:

Let the light source, ***S***, in the Mount-Wilson experiment, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** let θ stand for the angle of the instantaneous position of the apex of Earth's velocity, v, relative to the CMBR, with respect to the meridian of the laboratory; let v' stand for the mean orbital velocity of Earth, around the barycenter of the solar system; and let δ denote the angle of the geographical latitude of the laboratory, at which the Mount-Wilson experiment is carried out, in the refracting medium of air.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus:

1. At the geographical latitude ***7.2º S***:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the maximum velocity resultant:

$$\sqrt{\left[v + v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***5^h^ 12^m^***;

and in the direction of the minimum velocity resultant:

$$\sqrt{\left[v - v'\cos\left(11.1^o\right)\right]^2 + \left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***17^h^ 12^m^***.

While, in both cases, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And subsequently, at the geographical latitude of ***7.2^o^ S***, the annual maximum difference, Δt_{max}, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in a repetition of the Mount-Wilson experiment, can be computed, in accordance with the assumption of ballistic speed of light, as defined within the context of the elastic-impact emission theory, through the use of the following equation:

$$\Delta t_{\max} = \frac{2nL}{c}\left(\frac{\left(1 - \frac{\left(v^2 + v'^2 + 2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right) - \sqrt{1 - \frac{\left(v^2 + v'^2 + 2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}}{\sqrt{1 - \frac{\left(v^2 + v'^2 + 2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}\left(1 - \frac{\left(v^2 + v'^2 + 2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)}\right)$$

And, at the same geographical latitude, the annual minimum difference, Δt_{min}, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the same repetition of the Mount-Wilson experiment, can be calculated, on the basis of the assumption of ballistic speed of light, through the use of the following equation:

$$\Delta t_{\min} = \frac{2nL}{c}\left(\frac{\left(1 - \frac{\left(v^2 + v'^2 - 2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right) - \sqrt{1 - \frac{\left(v^2 v'^2 - 2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}}{\sqrt{1 - \frac{\left(v^2 + v'^2 - 2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}\left(1 - \frac{\left(v^2 + v'^2 - 2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)}\right)$$

where L is the extended length of each arm of the interferometer, through the use of the multiple-reflection method; v is Earth's velocity, with respect to the CMBR; v' is the orbital velocity of Earth, around the barycenter of the solar system; and c is the muzzle speed of light, in vacuum.

And it follows, therefore, that, by interesting, into the above two formulas, respectively, the following numerical data:

$$c = 299792458 \ \ \text{ms}^{-1}$$
$$v = 371000 \ \ \text{ms}^{-1}$$
$$v' = 29780 \ \ \text{ms}^{-1}$$
$$L = 32.000 \ \ \text{m}$$
$$n = 1.00029$$

the annual maximum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***7.2º S***, as calculated, for a repetition of the Mount-Wilson experiment, in accordance with the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, is equal to this numerical value, Δt_{max}:

$$\Delta t_{\max} = 1.10375 \times 10^{-16} \ \ \text{sec.}$$

And in a like manner, the annual minimum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***7.2º S***, as computed, for the same repetition of the Mount-Wilson experiment, in accordance with the assumption of ballistic speed of light, is equal to this numerical value, Δt_{min}:

$$\Delta t_{\min} = 8.04983 \times 10^{-17} \ \ \text{sec.}$$

And correspondingly, at the geographical latitude of ***7.2º S***, the predicted values of the annual variations, in the fringe-shift displacement, as calculated on the basis of the assumption of ballistic speed of light, vary, annually, due to Earth's orbital motion, around the gravitational center of the solar system, within this numerical range:

$$8.04983 \times 10^{-17} \leq \Delta t \leq 1.10375 \times 10^{-16} \ \ \text{sec.}$$

in which the upper limit is about ***1.37*** times larger than the lower limit.

2. At the geographical latitude of Mount Wilson, ***34.2264º N***:

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the maximum velocity resultant:

$$\sqrt{\left[v+v'\cos\left(11.1^o\right)\right]^2+\left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***5^h 12^m***;

and in the direction of the minimum velocity resultant:

$$\sqrt{\left[v-v'\cos\left(11.1^o\right)\right]^2+\left[v'\sin\left(11.1^o\right)\right]^2}$$

when Earth is at RA = ***17^h 12^m***.

While, at the same time, in both cases, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And therefore, at the geographical latitude of ***34.2264^o N***, the annual maximum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be calculated, on the basis of the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, through the use of the following equation:

$$\Delta t_{\max}=\frac{2nL}{c}\left(\frac{\left(1-\frac{\left(v^2+v'^2+2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)-\sqrt{1-\frac{\left(v^2+v'^2+2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}}{\sqrt{1-\frac{\left(v^2+v'^2+2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}\left(1-\frac{\left(v^2+v'^2+2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)}\right)$$

And, at the same geographical latitude, the annual minimum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be computed, in accordance with the assumption of ballistic speed of light, through the use of the following equation:

$$\Delta t_{\min}=\frac{2nL}{c}\left(\frac{\left(1-\frac{\left(v^2+v'^2-2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)-\sqrt{1-\frac{\left(v^2v'^2-2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}}{\sqrt{1-\frac{\left(v^2+v'^2-2vv'\cos\left(11.1^o\right)\right)\left(n^2-1\right)}{c^2}}\left(1-\frac{\left(v^2+v'^2-2vv'\cos\left(11.1^o\right)\right)\left(n-1\right)^2}{c^2}\right)}\right)$$

where ***L*** is the extended length of each arm of the interferometer, through the use of the multiple-reflection technique; ***n*** is the refractive index of air; ***v*** is Earth's velocity, with respect to the CMBR; ***v'*** is the orbital velocity of Earth, around the gravitational center of the solar system; and ***c*** is the muzzle speed of light, in vacuum.

And it follows, therefore, that, by interesting, into the above two formulas, respectively, the following observational data:

$$c = 299792458 \ \text{ms}^{-1}$$
$$v = 371000 \ \text{ms}^{-1}$$
$$v' = 29780 \ \text{ms}^{-1}$$
$$L = 32.000 \ \text{m}$$
$$n = 1.00029$$

the annual maximum difference, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***34.2264º N***, as computed, for the Mount-Wilson experiment, in accordance with the assumption of ballistic speed of light, is equal to this numerical value, Δt_{max}:

$$\Delta t_{\max} = 1.10375 \times 10^{-16} \ \text{sec.}$$

And likewise, the annual minimum difference, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***, at the geographical latitude of ***34.2264º N***, as calculated, for the Mount-Wilson experiment, on the basis of the assumption of ballistic speed of light, is equal to the following numerical value, Δt_{min}:

$$\Delta t_{\min} = 8.04983 \times 10^{-17} \ \text{sec.}$$

And correspondingly, at the geographical latitude of ***34.2264º N***, the predicted values of the annual variations, in the fringe-shift displacement, as calculated on the basis of the assumption of ballistic speed of light, due to Earth's orbital motion, around the gravitational center of the solar system, are within this numerical range:

$$8.04983 \times 10^{-17} \leq \Delta t \leq 1.10375 \times 10^{-16} \ \text{sec.}$$

in which the upper limit is about ***1.37*** times greater than the lower limit.

12. Concluding Remarks:

According to Dayton C. Miller's report, in each run of the Mount-Wilson experiment, the experimental apparatus is turned, around the perpendicular line to its horizontal plane, by an angle of azimuth of ***360°***; because, although the amount of observed fringe-shift displacement is proportional to the square of the ratio of the velocity of the earth to the velocity of light, v^2/c^2, the direction of the earth's absolute motion is unknown. And subsequently, the interferometer is caused to rotate, slowly, on the mercury float, in order for the telescope to point, successively, to all azimuths.

And furthermore, according to the same report, the rotation of the interferometer, by an angle of ***90º***, doubles the measured amount of the fringe-shift displacement; while, at the same time, the rotation of the same interferometer, by an angle of ***360º***, causes the observed fringe patterns to move, periodically, first to one side, then to the other side of the pointer or the stationary marker, with two complete periods, in each rotation.

But, even though, it seems, at first glance, qualitatively reasonable, it is not possible to verify, in a quantitative manner, whether or not the aforementioned experimental procedure works, precisely, as intended, prior to deriving, first of all, the mathematical formulas for calculating the time difference, Δt, between the total time of flight of the beam ***I***, and the total time of flight of the beam ***II***, along the two arms of the slowly rotating interferometer, on the basis of the assumption of constant speed of light, and on the basis of the assumption of ballistic speed of light, respectively.

1. According to the assumption of constant speed of light:

Let the light source, ***S***, in the Mount-Wilson experiment, emit the initial experimental beam, towards the half-silvered mirror, ***D***, with the speed of light, ***c;*** along the horizontal arm of the rotating interferometer in the direction of the velocity of Earth, ***v***, relative to the CMBR; let β stand for the angle, by which the experimental apparatus is being rotated; and, in order to simplify the calculations, let be assumed that the angle of the instantaneous position of the CMBR apex, θ, is equal to ***0º***.

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the slowly interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***.

And, at the same time, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And, accordingly, if the length of the horizontal path is equal to ***L***, then, according to the assumption of constant speed of light, the travel time of the beam ***I***, during the first leg of its journey, is equal to t_1:

$$t_1 = \frac{\sqrt{L^2 + v^2 t_1^2 + 2Lvt_1 \cos(\beta)}}{c} = L\left(\frac{\sqrt{c^2 - v^2 \sin^2(\beta)} + v\cos(\beta)}{c^2 - v^2}\right)$$

where β stands for the angle by which the interferometer is rotated.

And likewise, the travel time of the beam ***I***, during the second leg of its journey, is equal to t_2:

$$t_2 = \frac{\sqrt{L^2 + v^2 t_2^2 - 2Lvt_2 \cos(\beta)}}{c} = L\left(\frac{\sqrt{c^2 - v^2 \sin^2(\beta)} - v\cos(\beta)}{c^2 - v^2}\right)$$

where ***L*** is the length of the light path.

And correspondingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2 = \frac{2L}{c}\left(\frac{\sqrt{1 - \frac{v^2}{c^2}\sin^2(\beta)}}{1 - \frac{v^2}{c^2}}\right)$$

where ***c*** is the speed of light, in vacuum; and ***v*** is the velocity of the earth, relative to the CMBR.

It should be taken into consideration, in this particular case, that the total path of the transverse beam ***II***, no longer, forms an isosceles triangle; and hence; the two parts of its journey, have to be computed, separately.

And subsequently, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***II***, during the first leg of its journey, is equal to t_3:

$$t_3 = \frac{\sqrt{L^2 + v^2 t_3^2 + 2Lvt_3 \cos(\beta + 90^o)}}{c} = L\left(\frac{\sqrt{c^2 - v^2 \sin^2(\beta + 90^o)} + v\cos(\beta + 90^o)}{c^2 - v^2}\right)$$

where ***β*** is the angle, by which the experimental apparatus is being rotated.

And likewise, the travel time of the beam ***II***, during the second leg of its journey, is equal to t_4:

$$t_4 = \frac{\sqrt{L^2 + v^2 t_4^2 - 2Lvt_4 \cos(\beta + 90^o)}}{c} = L\left(\frac{\sqrt{c^2 - v^2 \sin^2(\beta + 90^o)} - v\cos(\beta + 90^o)}{c^2 - v^2}\right)$$

And accordingly, the total travel time of the beam ***II***, is equal to ***t'***:

$$t' = t_3 + t_4 = \frac{2L}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}\sin^2\left(\beta+90^o\right)}}{1-\frac{v^2}{c^2}}\right)$$

And it follows, therefore, that the numerical difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be calculated, on the basis of the assumption of constant speed of light, through the use of the following equation:

$$\Delta t = t - t' = \frac{2L}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}\sin^2\left(\beta\right)}-\sqrt{1-\frac{v^2}{c^2}\sin^2\left(\beta+90^o\right)}}{1-\frac{v^2}{c^2}}\right)$$

where ***t*** is the total travel time, for the beam ***I***; and ***t'*** is the total travel time, for the beam ***II***.

And so, now, the important question, within the current context, is this:

Does the rotation of the interferometer, by an angle of azimuth of ***90°***, increase the amount of measured fringe-shift displacement, by a factor of ***2***; as Dayton C. Miller believed that it should?

As far as the assumption of constant speed of light is concerned, whenever the condition ***{β = 90°}*** is fulfilled, the above equation, for computing ***Δt***, is reduced to this simple formula, for obtaining the absolute value of the numerical difference, ***Δt***, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***:

$$\Delta t = \left|\frac{2L}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}}-1}{1-\frac{v^2}{c^2}}\right)\right|$$

in which the expression:

$$\frac{2L}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}}-1}{1-\frac{v^2}{c^2}}\right)$$

is, necessarily, negative; because, the previously slower beam ***I*** becomes faster, and the previously faster beam ***II*** becomes slower, upon rotating the interferometer, around the plumb line, by an angle of ***90º***.

And it has to be concluded, therefore, that it's, indeed, true, as Dayton C. Miller pointed out, in his experimental report, that the rotation of the interferometer, by an angle of ***90º***, doubles the measured amount of the fringe-shift displacement; while, at the same time, the rotation of the same interferometer, by an angle of ***360º***, causes the observed fringe patterns to move, periodically, first to one side, then to the other side of the pointer or the stationary marker, with two complete periods, in each rotation.

And, finally, what will happen to the fringe patterns, as observed by Dayton C. Miller, on the summit of Mount Wilson, in the special case, in which the interferometer is being rotated, by an angle of azimuth of ***45°***?

Clearly, whenever the angle of ***β*** is replaced with the angle of ***45°***, in this equation:

$$\Delta t = t - t' = \frac{2L}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}\sin^2(\beta)}-\sqrt{1-\frac{v^2}{c^2}\sin^2(\beta+90^o)}}{1-\frac{v^2}{c^2}}\right)$$

the value of the numerical difference, ***Δt***, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, becomes equal to ***0***; and hence, the fringe patterns must be at the middle of their shifting range; i.e., on the top of the stationary pointer.

And therefore, according to the assumption of constant speed of light, during each rotation of the interferometer, around the vertical line to the horizontal plane of the laboratory, through an angle of ***360º***, the numerical difference, ***Δt***, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, must be equal to ***0***; and the fringe patterns at the middle of their range, at these four angles of rotation of the interferometer: ***45°***, ***135°***, ***225°***, and ***315°***, as illustrated in **Figure #*8***, below:

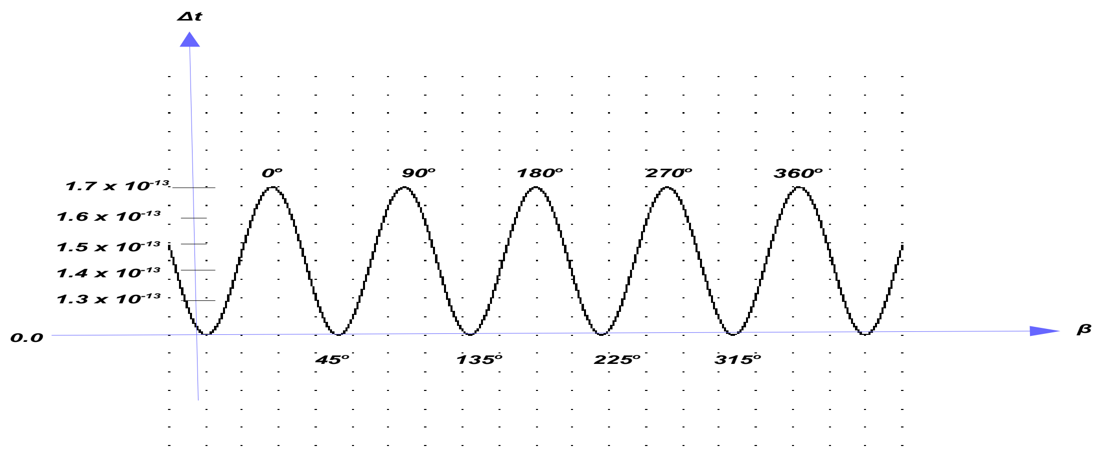

Figure #*8:* Fringe-shift variations due to the rotation of the interferometer

There are clear indications that the superposition of the above sinusoidal variations, due to the rotation of the interferometer, and the daily fringe-shift variations, due to the rising and setting of the CMBR apex, with respect to the meridian of Mount Wilson, along with the seasonal fringe-shift variations, due to Earth's orbital motion, around the barycenter of the solar system, is one of the main causes behind the relatively large errors, in determining the magnitude and pinpointing the direction of Earth's space motion, on the basis of the pioneering and immense experimental work of Dayton C. Miller; in addition, of course, to the insufficient sample of collected experimental data, and the overstretched and somewhat sporadic runs of the Mount-Wilson experiment.

In any case, as demonstrated, in the current investigation, the computed predictions, on the basis of the assumption of constant speed of light, according to which the speed of light is independent of the speed of the light source, at the geographical latitude of Mount Wilson, ***34.2264º N***, are within this numerical range:

$$7.15653 \times 10^{-14} \le \Delta t \le 1.63469 \times 10^{-13} \text{ sec.}$$

where the lower limit of which is about ***600*** times larger than the reported result of the Mount-Wilson experiment, for the time difference, ***Δt***, between the total time of flight of the slower beam ***I***, and the total time of flight of the faster beam ***II***.

And, consequently, those computed predictions, in accordance with the assumption of constant speed of light, as defined within the framework of the classical wave theory, notwithstanding their robustness and striking generality, are much larger; and definitely, they can neither be reconciled, nor made, somehow, consistent with the reported experimental result of ***1.19 x 10⁻¹⁶ s***, without the employment of a helper hypothesis such as the ether-drift hypothesis, as devised, on the fly, by Dayton C. Miller, for his Mount-Wilson experiment.

However, it is not possible, at all, to investigate, or to examine, in details, Dayton C. Miller's ether-drift hypothesis, on theoretical grounds; because it is, by its very definition, entirely empirical; i.e., no predictions, theoretically coherent, or otherwise, can be calculated, on the basis of that hypothesis, in advance.

2. According to the assumption of ballistic speed of light:

It should be clear that, in accordance with the assumption of the ballistic speed of light, the rotation of the interferometer, around the perpendicular line to the floor of the laboratory, by an angle of ***360º***, in the Mount-Wilson experiment, leads to similar sinusoidal variations, in the numerical values of the fringe-shift displacement, as calculated above, on the basis of the assumption of constant speed of light, if and, only. if the experiment, under discussion, is carried out in a medium, the refractive index of which is greater than ***1***; i.e.,

$$n > 1$$

To derive the relevant mathematical formulas, therefore, let the light source, ***S***, in the Mount-Wilson experiment, emit the initial experimental beam towards the half-silvered mirror, ***D***, with the muzzle speed of light, ***c;*** along the horizontal arm of the rotating interferometer in the direction of the velocity of Earth, ***v***, relative to the CMBR; and let ***β*** denote the rotational angle of Dayton C. Miller's experimental apparatus..

And let the half-silvered mirror, ***D***, split the initial beam, into the beam ***I***, and the beam ***II***, which travel, at right angles to each other, along the two arms of the interferometer, in Dayton C. Miller's experimental apparatus.

The beam, ***I***, is transmitted by the half-silvered mirror, ***D***, horizontally, in the direction of the velocity vector, ***v***.

While, at the same time, the beam, ***II***, is reflected, by the same half-silvered mirror, ***D***, transversely, at right angles to the direction of the same velocity resultant**.**

And, accordingly, if the length of the horizontal path is equal to ***L***, then, according to the assumption of ballistic speed of light, the travel time of the beam ***I***, during the first part of its round trip, is equal to t_1:

$$t_1 = \frac{\sqrt{\left[L + vt_1\cos(\beta)\right]^2 + \left[vt_1\sin(\beta)\right]^2}}{\sqrt{\frac{c^2}{n^2} + \frac{v^2}{n^2} + \frac{2cv\cos(\beta)}{n^2}}} = \frac{nL}{c}\left(\frac{\sqrt{1 + \frac{v^2}{c^2}\left(1 - n^2\sin^2(\beta)\right) + 2\frac{v}{c}\cos(\beta)} + \frac{v}{c}n\cos(\beta)}{1 + \frac{v^2}{c^2}\left(1 - n^2\right) + 2\frac{v}{c}\cos(\beta)}\right)$$

where ***β*** stands for the angle by which the interferometer is rotating.

And similarly, the travel time of the beam ***I***, during the second part of its round trip, is equal to t_2:

$$t_2 = \frac{\sqrt{\left[L - vt_2\cos\left(\beta\right)\right]^2 + \left[vt_2\sin\left(\beta\right)\right]^2}}{\sqrt{\frac{c^2}{n^2} + \frac{v^2}{n^2} - \frac{2cv\cos\left(\beta\right)}{n^2}}} = \frac{nL}{c}\left(\frac{\sqrt{1 + \frac{v^2}{c^2}\left(1 - n^2\sin^2\left(\beta\right)\right) - 2\frac{v}{c}\cos\left(\beta\right)} - \frac{v}{c}n\cos\left(\beta\right)}{1 + \frac{v^2}{c^2}\left(1 - n^2\right) - 2\frac{v}{c}\cos\left(\beta\right)}\right)$$

where ***L*** is the length of the light pat; and ***n*** is the refractive index.

And correspondingly, the total travel time of the beam ***I***, is equal to ***t***:

$$t = t_1 + t_2$$

where t_1 is the travel time of the beam ***I***, during the first leg; and t_2 is its travel time, during the second leg of its round trip.

And likewise, if the length of the transverse path, in the Mount-Wilson experiment, is equal to ***L***, then the travel time of the beam ***II***, during the first part of its journey, is equal to t_3:

$$t_3 = \frac{\sqrt{\left[L + vt_3\cos\left(\beta + 90^o\right)\right]^2 + \left[vt_3\sin\left(\beta + 90^o\right)\right]^2}}{\sqrt{\frac{c^2}{n^2} + \frac{v^2}{n^2} + \frac{2cv\cos\left(\beta + 90^o\right)}{n^2}}} = \frac{nL}{c}\left(\frac{\sqrt{1 + \frac{v^2}{c^2}\left(1 - n^2\sin^2\left(\beta + 90^o\right)\right) + 2\frac{v}{c}\cos\left(\beta + 90^o\right)} + \frac{v}{c}n\cos\left(\beta + 90^o\right)}{1 + \frac{v^2}{c^2}\left(1 - n^2\right) + 2\frac{v}{c}\cos\left(\beta + 90^o\right)}\right)$$

where ***c*** is the muzzle speed of light, in vacuum; and ***β*** is the angle by which the interferometer is being rotated, around the vertical line to the horizontal plane of the laboratory.

And furthermore, the travel time of the beam ***II***, during the second part of its journey, is equal to t_4:

$$t_4 = \frac{\sqrt{\left[L - vt_2\cos\left(\beta + 90^o\right)\right]^2 + \left[vt_2\sin\left(\beta + 90^o\right)\right]^2}}{\sqrt{\frac{c^2}{n^2} + \frac{v^2}{n^2} - \frac{2cv\cos\left(\beta + 90^o\right)}{n^2}}} = \frac{nL}{c}\left(\frac{\sqrt{1 + \frac{v^2}{c^2}\left(1 - n^2\sin^2\left(\beta + 90^o\right)\right) - 2\frac{v}{c}\cos\left(\beta + 90^o\right)} - \frac{v}{c}n\cos\left(\beta + 90^o\right)}{1 + \frac{v^2}{c^2}\left(1 - n^2\right) - 2\frac{v}{c}\cos\left(\beta + 90^o\right)}\right)$$

where ***v*** is the velocity of Earth, relative to the CMBR; and ***n*** is the refractive index of air.

And accordingly, the total travel time of the beam ***II***, is equal to ***t′***:

$$t' = t_3 + t_4$$

where t_3 is the travel time of the beam ***II***, during the first leg; and t_4 is the travel time of the same beam, during the second leg of its round trip.

And it follows, therefore, that, according to the assumption of ballistic speed of light, the numerical difference, Δt, between the total travel of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, can be obtained through the use of the following equation:

$$\Delta t = t' - t$$

where t is the total travel time of the beam ***I***; and t' is the total travel time of the beam ***II***.

And so, once again, based on the assumption of ballistic speed of light, as defined within the framework of the elastic-impact emission theory, does the rotation of the interferometer, around the perpendicular line to the floor of the laboratory, by an angle of azimuth of ***90°***, increase the amount of measured fringe-shift displacement, by a factor of ***2***; as Dayton C. Miller thought it does?

As far as the assumption of ballistic speed of light is concerned, whenever the condition $\{\beta = 90°\}$ is satisfied, the above four equations, for computing Δt, are reduced to this single equation:, for calculating the numerical value of the time difference, Δt, between the total travel of the faster beam ***I***, and the total travel time of the slower beam ***II***:

$$\Delta t = t' - t = \frac{2nL}{c}\left(\frac{\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}-\left(1-\frac{v^2}{c^2}\left(n-1\right)^2\right)}{\left(1-\frac{v^2}{c^2}\left(n-1\right)^2\right)\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}}\right)$$

in which the expression:

$$\left(\frac{\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}-\left(1-\frac{v^2}{c^2}\left(n-1\right)^2\right)}{\left(1-\frac{v^2}{c^2}\left(n-1\right)^2\right)\sqrt{1-\frac{v^2}{c^2}\left(n^2-1\right)}}\right)$$

is necessarily, negative; because .the previously slower beam ***II*** becomes faster, and the previously faster beam ***I*** becomes slower, upon rotating the interferometer, around the plumb line, by an angle of ***90º***.

And it follows, therefore, that it's, indeed, true, as Dayton C. Miller stated, in his experimental report, that the rotation of the interferometer, around the perpendicular line to the horizontal plane of the laboratory, by an angle of ***90º***, doubles the measured amount of the fringe-shift displacement; while, at the same time, the rotation of the same interferometer, by an angle of ***360º***, causes the observed fringe patterns to move, periodically, first to one side, then to the other side of the pointer or the stationary marker, with two complete periods, in each rotation.

And, one more time, what will happen to the fringe patterns, as observed by Dayton C. Miller, on the summit of Mount Wilson, in the special case, in which the interferometer is rotated, by an angle of azimuth of ***45°***?

Obviously, whenever the angle of ***β*** is replaced with the angle of ***45°***, in the above four equations, the value of the numerical difference, ***Δt***, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, becomes equal to ***0***; i.e.,

$$\begin{aligned} &\beta = 45^o \\ &t_1 = t_3 \\ &t_2 = t_4 \\ &\Delta t = (t_3 + t_4) - (t_1 + t_2) = 0 \end{aligned}$$

and hence, the fringe patterns must be at the middle of the shift range.

And moreover, according to the assumption of ballistic speed of light, during one rotation of the interferometer, around the perpendicular line to the floor of the laboratory, through an angle of ***360º***, the numerical difference, ***Δt***, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, is equal to ***0***; and the fringe patterns are at the middle of their range, at these four angles of rotation of the interferometer: ***45°***, ***135°***, ***225°***, and ***315°***, as illustrated in **Figure #9**, below:

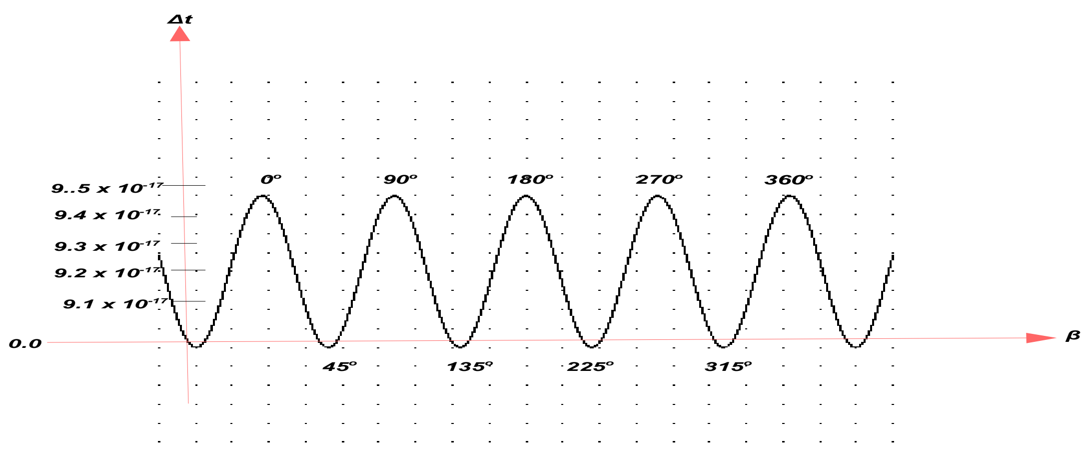

Figure #9: Fringe-shift variations due to the rotation of the interferometer

And, finally, as shown earlier, in this discussion, the computed predictions, on the basis of the assumption of ballistic speed of light, according to which the speed of light is dependent upon the speed of the light source, at the geographical latitude of Mount Wilson, ***34.2264º N***, are within this numerical range:

$$4.15138 \times 10^{-17} \le \Delta t \le 9.48258 \times 10^{-17} \quad \text{sec.}$$

in which the upper limit, for the time difference, Δt, is about ***0.8*** times the experimental result of ***1.19 x 10^{-16} s***, as measured by Dayton C. Miller, in the Mount-Wilson experiment.

And although the lower limit of the above numerical range, for the predicted values of the time difference, Δt, is about ***0.35*** times the reported experimental result of ***1.19 x 10^{-16} s***, the computed predictions, on the basis of the assumption of ballistic speed of light, are still, generally, closer to the reported result of the Mount-Wilson experiment, and much more satisfactory than the calculated predictions, in accordance with the assumption of constant speed of light, for the same experiment, for these main reasons:

1. The measurements of the Mount-Wilson experiment, itself, must have had a relatively large margin of error; otherwise, Dayton C. Miller, himself, would have been able to determine the exact magnitude and the exact direction of the space motion of the planet Earth, with respect to the CMBR, many years before the discovery of the Cosmic Microwave Background Radiation (CMBR), by Arno Penzias and Robert Woodrow Wilson, in ***1964***.

2. The average value of the above numerical range, as computed in accordance with the assumption of ballistic speed of light, is consistent with the reported value of the experimental result, which, itself, is the average value of the experimental data, gathered, over a number of years, by Dayton C. Miller, in his Mount-Wilson experiment.

3. The above numerical range for the predicted values of Δt, as computed, in accordance with the assumption of ballistic speed of light, for a total light path of ***64*** meters, in the Mount-Wilson experiment, leads to the following numerical range:

$$1.41458 \times 10^{-17} \le \Delta t \le 3.25964 \times 10^{-17}$$

for a total light path of ***22*** meters, in the Michelson-Morley experiment; and which the upper limit of which is equal to about ***0.088*** of the total time difference Δt of ***3.70 x 10^{-16}*** sec. [***Ref. #20***], which Albert A. Michelson and Edward W. Morley were looking for. And subsequently, the above numerical range, for the predicted values of Δt, as calculated on the basis of the assumption of ballistic speed of light, is, clearly, consistent with the reported result of the Michelson-Morley experiment [***Ref. #1***].

In a nutshell, the above numerical range of the theoretical values predicted, on the basis of the assumption of ballistic speed of light, is, so to speak, the best of all numerical ranges, for getting as close as possible to the reported result of the Mount-Wilson experiment, and to the reported result of the Michelson-Morley experiment, at the same time.

And, finally, is it, theoretically, possible, for the calculated results of the time difference ***Δt***, on the basis of the assumption of ballistic speed of light, between the total travel time of the beam ***I***, and the total travel time of the beam ***II***, in the Mount-Wilson experiment, as well as, in the Michelson-Morley experiment, both carried out in high vacuum, to have a numerical value greater than ***0***?

If it's possible, in practice, in the aforementioned experiments, to turn, in high vacuum, the experimental apparatus on its edge, in order to make the horizontal arm of the interferometer — the arm along the extension of which the light source is located — coincide with the direction of the gravitational vector of the earth, ***g***, then it should be, possible, in accordance with the assumption of ballistic speed of light, to obtain a numerical value, for the time difference, ***Δt***, which, in the case of a total light path of ***64*** meters, is equal to about 2.4×10^{-21} ***sec***., and which, of course, is, obviously, far beyond the measuring capability of Dayton C. Miller's interferometer, and the measuring capability of the Michelson-Morley interferometer, in both experiments.

In conclusion, therefore, the scientific work of Dayton C. Miller, in his Mount-Wilson experiment, on the determination of the space motion of the planet Earth, has, approximately, the same level of accuracy, significance, and, definitely, the same pioneering characteristic of the scientific work of Ole Rømer, on the determination of the speed of light. And, undoubtedly, physics textbooks will, at some time in the future, have to give him the full credit, along with the well-deserved praise, for his tremendous effort and outstanding discovery.

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