Gravity and Light Speed

by

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Abstract

All relevant experiments that disagree with static or entrained ether vice versa that led to the historical breakthrough of Special Relativity [1] will be revised from the scratch. It will be shown that an alternative model based on rightly understood gravitational dragging of light is able to explain the notorious phenomena. Invariance of light speed, time dilation and Lorentz contraction [2] will become obsolete. Focus is laid on the most problematic subjects as there are: Stellar and terrestrial aberration, anomaly of Mercury orbit shift, Sagnac effect [3] and Michelson/Gale/Pearson/Pearson [4] versus Michelson/Morley [5] experiment.

1. Introduction

The historic dispute about ether theories was circling around the problem of stellar and terrestrial aberration. Understanding of the nature of light was never brought to an end, when Special Relativity [1] prematurely terminated any further investigation on this topic. Generally spoken, static ether concepts [2] were explaining stellar aberration but failed on terrestrial aberration, entrained ether concepts [6] [7] vice versa. A similar picture is given by the experimental evidence, the Sagnac effect [3] as well as the Michelson/Gale/Pearson [4] experiment are esteemed to be disproving entrained ether but being in accordance with static ether, the Michelson/Morley [5] experiment attests the opposite. Special Relativity [1] solved all the contradictions by postulating invariance of light speed, but at the expense of logical reason.

2. Stellar aberration

First we will assume a static ether and purely wave nature of light in order to clarify the aberrational phenomena, i.e. movement of light source does not affect light propagation.

The classic explanation of stellar aberration [8] was, that similar to the falling rain drop, the telescope would have to be twisted in order to follow the light ray since the telescope itself was moving sidewise by earth

rotation or earth orbiting respectively. If the ether on the other side was fully dragged by earth, no such aberration could occur at all, because the light ray would always follow earth's movement. On the other hand it was found difficult to explain aberration at all assuming a pure wave nature of light.

The great misunderstanding is, that stellar aberration in truth does not have anything to do with the telescope having to follow the light path within the short distance inside the telescope nor the still short distance within earth's atmosphere nor even the short distance within the gravitational influence of earth or even the solar system, but the whole distance that light travels from its source, i.e. the distance from stars being billions of lightyears away.

The following images show, how a spherical wave of light will be emitted by its source deliberately long ago, whereby the observer is travelling by deliberate speed. For convenience the following model values were chosen:

Light speed c: 1,5 km/sec

Earth movement speed v: 0,4 to 0,6 km/sec against static ether on orbital path

Distance of earth path to light source: 1,5 km

Middling angle of observation at 0,5 km/sec towards source: 60° degree

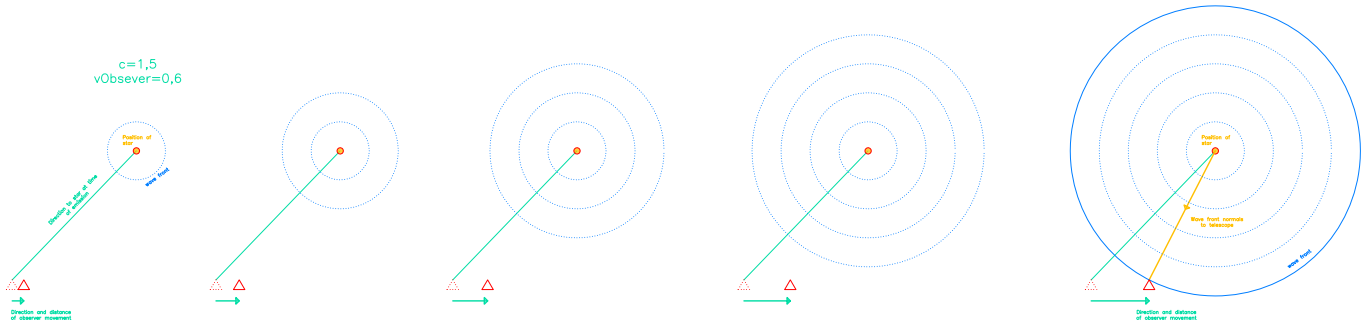

Fig. 1: Light propagation from source with 0,3 sec steps, earth's speed 0,6 km/sec

It can be seen, that the observer is moving sidewise during the complete period that the light wave front travels from the source to meet the observer. It is important to mention that at this instant the light wave front hits the observer as a wave normal, and all subsequent wave fronts do as well.

Only now we have established the angle, under which the light ray meets the observer, and we add a telescope for better understanding:

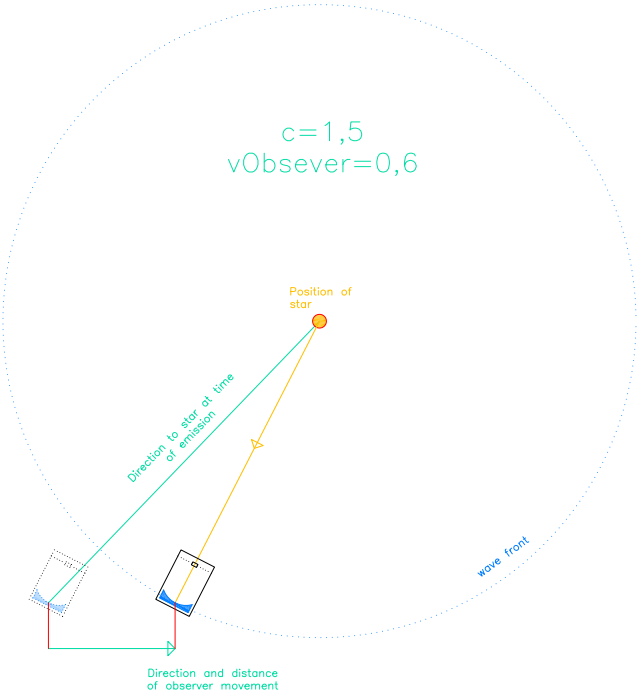

Fig. 2 Telescope directed to source.

In this model the observation angle will amount to 62,8542°, as shown per calculation later. All distances, angles and relations of speeds are on scale at the model, verified by means of cad.

Now the same procedure with 0,4 km/sec earth's movement speed:

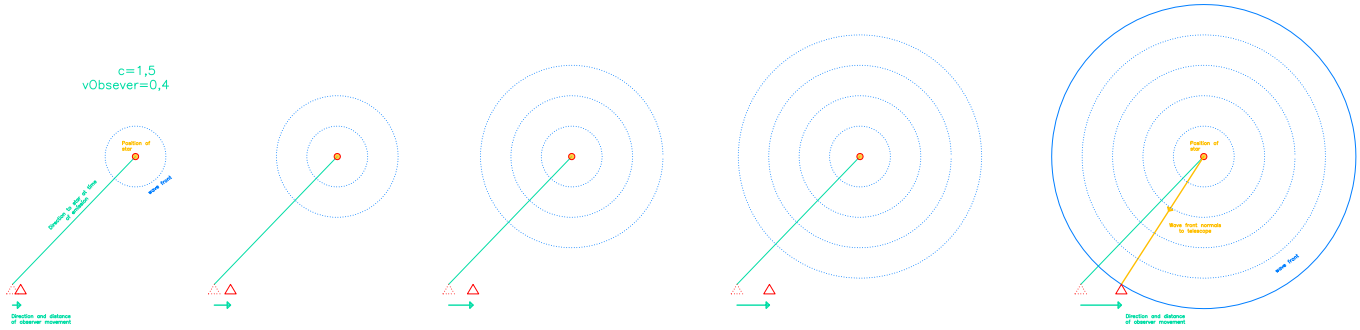

Fig. 3: Light propagation from source with 0,3 sec steps, earth's speed 0,4 km/sec

Of course, as before, again the meeting point represents a series of wave normals. But as can be seen by adding the telescope, the observation angle this time is 57,1806°.

Now the two images of both earth's movement speeds will be overlayed:

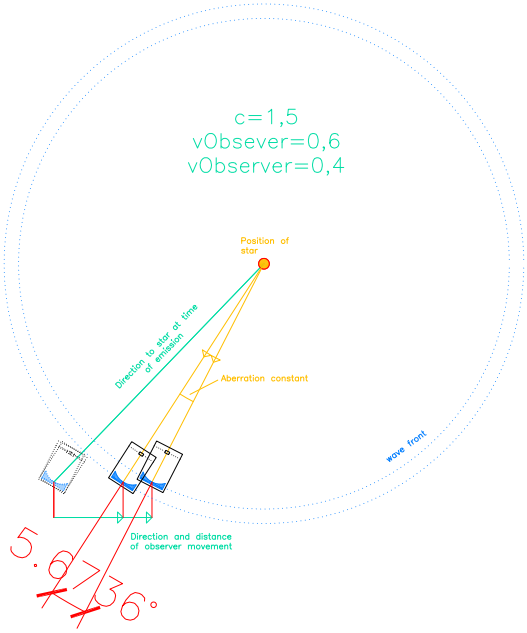

Fig. 4: Overlay both situations 0,6 and 0,4 km/sec

The angle between the two light rays now, in this case 5,6736° is deemed to be the common aberration angle. It is most important that this angle is deriving from the difference of the total earth's speed against the static ether e.g. CMB (Cosmic Microwave Background), but not necessarily the earth's speed on the orbit (being 0,2 km/sec in this model).

From the overlay it can be seen also, that both rays do not meet at the same time, since wave fronts do not have equal diameters.

Now the task will be done to show what happens if the middling observation angle is 90°, i.e. the object's / source's position is on the zenith. Only the final overlay is being shown, again the ray turns out to be defined by consecutive wave front normals:

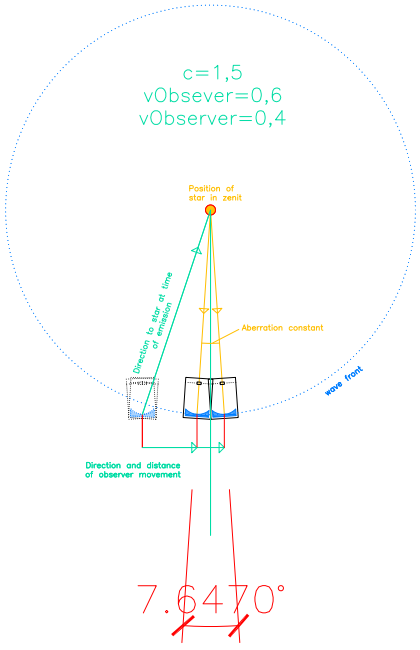

Fig. 5: Overlay 0,6 and 0,4 km/sec but on 90° middling observation angle

Obviously even with the small relation of values for c and v, the diameters of both wave fronts are very close and no more visible on this scale image.

Now it might be also interesting, how the concept behaves when the light source is moving:

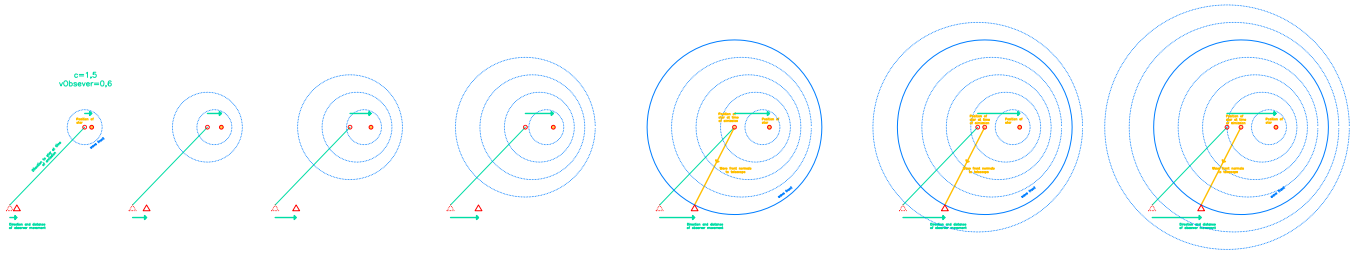

Fig. 6: Light propagation from source speed 0,6 km/sec with 0,3 sec steps, earth's speed 0,6 km/sec

It becomes clear that the aberration still exists the same way as if the source was not moving. The observer still receives only wave normals, but in this case from ever different source's position. The Doppler effect [9] behaves strictly in the classical way.

The determination of the aberration angle is done geometrically. First the angle between observer at time of emission and the source will be calculated:

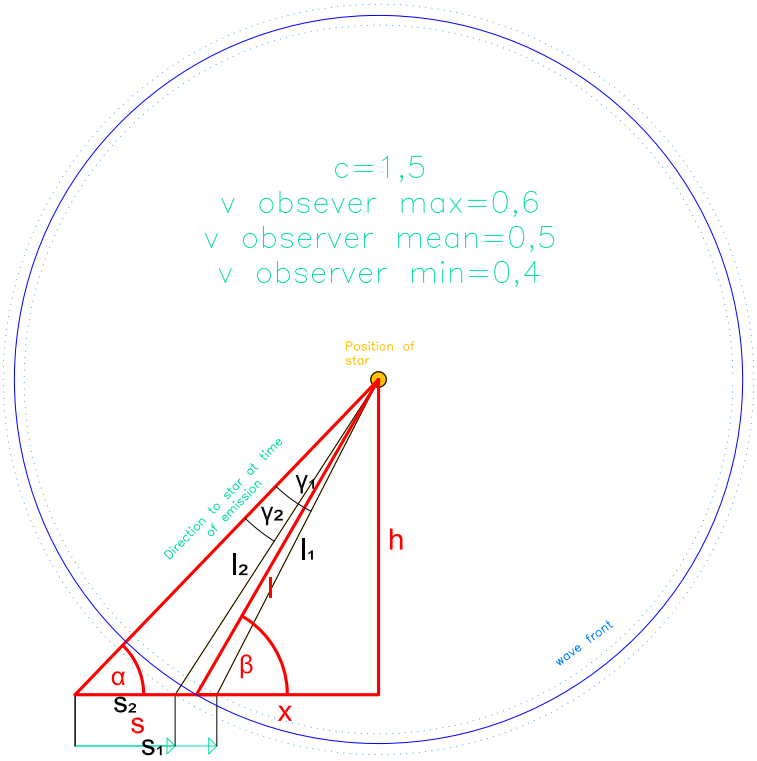

Fig. 7: Geometric model of 60° observation angle at mean speed

(1) $\tan(\alpha) = \frac{h}{s+x}$

(2) $\tan(\beta) = \frac{h}{x} \Rightarrow h = \tan(\beta) \bullet x$

(3) $\cos(\beta) = \frac{x}{l} \Rightarrow x = \cos(\beta) \bullet c$

Now insert (3) in (2)

(4) $h = \tan(\beta) \bullet \cos(\beta) \bullet c = \sin(\beta) \bullet c$

Now insert (4) and (3) in one:

$$\tan(\alpha) = \frac{\tan(\beta) \bullet \cos(\beta) \bullet c}{s + \cos(\beta) \bullet c} \Rightarrow \tan(\alpha) = \frac{\sin(\beta) \bullet l}{s + \cos(\beta) \bullet l} \Rightarrow \tan(\alpha) = \frac{\sin(\beta)}{\frac{s}{l} + \cos(\beta)} \Rightarrow \boxed{\tan(\alpha) = \frac{\sin(\beta)}{\frac{v}{c} + \cos(\beta)}}$$

Now it is important to acknowledge that the angle of aberration at maximum speed against the mean speed is different form the angle at minimum speed against mean speed, i.e. the full aberration angle is not simply double of one of the angles. First we calculate one of the angles:

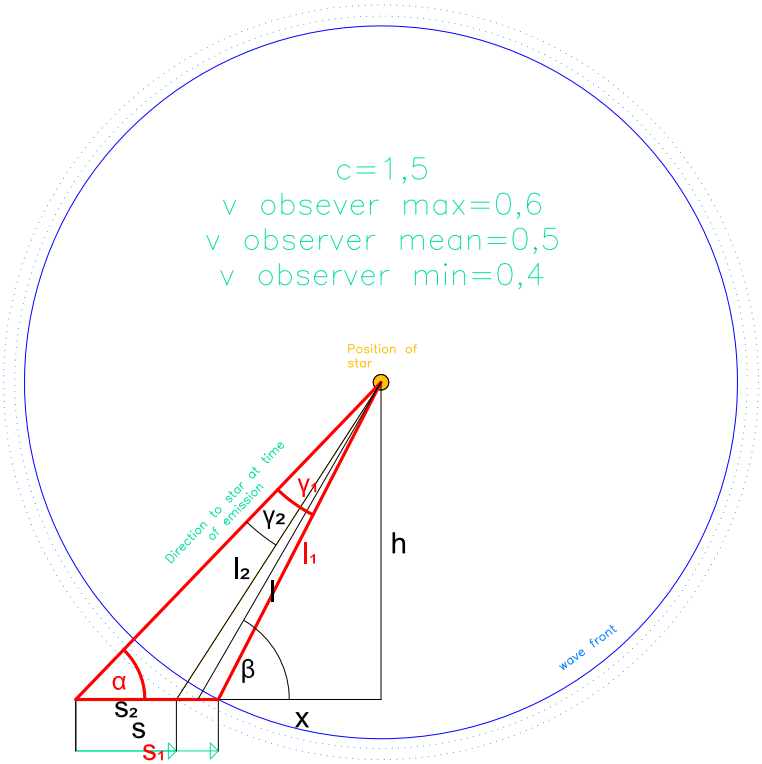

Fig. 8: Geometric model of 60° observation angle at maximum speed

(1) $\sin(\gamma_1) = \frac{s_1}{l_1} \cdot \sin(\alpha) = \frac{v_1}{c} \cdot \sin(\alpha)$

(2) $\tan(\alpha) = \frac{\sin(\beta)}{v/c + \cos(\beta)} \Rightarrow \alpha = \arctan\left(\frac{\sin(\beta)}{v/c + \cos(\beta)}\right)$ (from above)

Now insert (2) in (1):

arbitrary observation angle β at speed v1

$$\sin(\gamma_1) = \frac{v_1}{c} \cdot \sin\left(\arctan\left(\frac{\sin(\beta)}{v/c + \cos(\beta)}\right)\right)$$

arbitrary observation angle β at speed v2

$$\sin(\gamma_2) = \frac{v_2}{c} \cdot \sin\left(\arctan\left(\frac{\sin(\beta)}{v/c + \cos(\beta)}\right)\right)$$

For 90° observation angle sin(β)=1 und cos(β)=0

$$\sin(\gamma_1) = \frac{v_1}{c} \cdot \sin\left(\arctan\left(\frac{c}{v}\right)\right)$$

$$\sin(\gamma_1) = \frac{v_1}{c} \cdot \frac{\frac{c}{v}}{\sqrt{1 + c^2/v^2}} = \frac{v_1}{c} \cdot \frac{\frac{c}{v}}{\sqrt{1 + c^2/v^2}}$$

90° observation angle at speed v_1

$$\sin(\gamma_1) = \frac{v_1}{v} \cdot \frac{1}{\sqrt{1 + c^2/v^2}}$$

90° observation angle at speed v_2

$$\sin(\gamma_2) = \frac{v_2}{v} \cdot \frac{1}{\sqrt{1 + c^2/v^2}}$$

And the full aberration angle is the difference of the above angles. Any similarity to the Lorentzian length contraction factor γ [2] is coincidence but might also be of relevance for further investigations.

On the basis of above formulae it is convenient to produce an excel sheet to play with different speeds, distances and angles. The following values were set:

Light speed c: 299.792 km/sec

Earth movement speed v: 300 km/sec +/- 29,78 km/sec on orbital path

Distance of earth path to light source: 20.000 lightyears

Middling angle of observation at 300 km/sec towards source: 90° degree

	higher speed km/s, Grad	mean speed km/s, Grad	lower speed km/s, Grad	
c	299.792,00000	299.792,00000	299.792,00000	
v Earth 368 km/s (+/- 29,78 km/s on orbit)	397,78000	368,0000000000000	338,22000	
Incident angle light ray degree	90,00569	90,00000	89,99431	0,011383014335 Difference low/high values is aberration angle x 2
Radian	1,57090	1,57080	1,57070	0,005691507167320 aberration angle
				20,4894258024 Aberration angle arcsec
Distance earth path to source km	1,8908481E+20	1,8908481E+20	1,8908481E+20	
lightyears		20.000.000,00000		
angle difference observer-star to incident angle	0,07602305829156	0,07033155077724	0,06464004395692	0,0113830143346
Angle observer to star at emission degree	89,92967	89,92967	89,92967	
Radian	1,56957	1,56957	1,56957	
pathlength earth	2,508878E+17	2,321050E+17	2,133221E+17	3,756568E+16 Difference low/high values
pathlength light	1,890848E+20	1,890848E+20	1,890848E+20	3,080192E+06 Difference low/high values
part				1,629000E-14

Fig. 9: Calculation sheet with realistic values

The resulting aberration angle is 20,4894”, properly matching the observations. Interestingly there is still a time lack between both wave front spheres of approx. one part of a trillion at 90°, amounting to a distance deviation of approx. 35.000 km in this case that could be responsible for observed irregularities of planet’s orbits. The deviation is progressively increasing on flat observation angles. **On the scale of mercury, observed under 60° the deviation would be approx. 10.000 km, well explaining the anomaly of Mercury orbit deviation.**

	higher speed km/s, Grad	mean speed km/s, Grad	lower speed km/s, Grad	
c	299.792,00000	299.792,00000	299.792,00000	
v Earth 368 km/s (+/- 29,78 km/s on orbit)	397,78000	368,00000	338,22000	
Incident angle light ray degree	60,00493	**60,00000**	59,99507	0,00985 Difference low/high values is aberration angle x 2
Radian	1,04728	1,04720	1,04711	0,00493 aberration angle
				17,73348 Aberration angle arcsec
Distance earth path to source km	92.000.000,00000	92.000.000,00000	92.000.000,00000	
lightyears		0,00001		
angle difference observer-star to incident angle	0,06580	0,06087	0,05595	
Angle observer to star at emission degree	59,93913	59,93913	59,93913	
Radian	1,04614	1,04614	1,04614	
pathlength earth	140.947,87888	130.402,21696	119.855,50904	21.092,36983 Difference low/high values
pathlength light	106.227.177,09255	106.232.449,53094	106.237.723,27750	**-10.546,18495 Difference low/high values**
part				-0,0000992697

Fig. 10: Results on mercury perihelion shift

Now for checkup the distance is set to 1.000 km and again 90°, resulting in again 20,4894”

	higher speed km/s, Grad	mean speed km/s, Grad	lower speed km/s, Grad	
c	299.792,00000	299.792,00000	299.792,00000	
v Earth 368 km/s (+/- 29,78 km/s on orbit)	397,78000	368,0000000000000	338,22000	
Incident angle light ray degree	90,00569	90,00000	89,99431	0,011383014335 Difference low/high values is aberration angle x
Radian	1,57090	1,57080	1,57070	0,005691507167320 aberration angle
				20,4894258024 Aberration angle arcsec
Distance earth path to source km	1,0000000E+03	1,0000000E+03	1,0000000E+03	
lightyears		0,00000		
angle difference observer-star to incident angle	0,07602305829156	0,07033155077724	0,06464004395692	0,0113830143346
Angle observer to star at emission degree	89,92967	89,92967	89,92967	
Radian	1,56957	1,56957	1,56957	
pathlength earth	1,32685329149042	1,22751774563691	1,12818221189572	0,198671079594692000 Difference low/high values
pathlength light	1.000,00000493362000	999,99999999995000	1.000,00000493360000	0,000000000162572178 Difference low/high values
part				0,000000000000162572

Fig. 11: Calculation sheet with realistic values but unrealistic short distance

Obviously distance is irrelevant for the aberration angle, as it should be.

The fact that it has been herewith proved that the aberration is resulting from the whole distance between source and observer alone, makes it almost irrelevant if the light ray is entrained on the short piece in close distance of source or observer. Since the influencing distance is vanishingly short against the distance between observer and source, the aberration must have already happened on its way. Also experiments with water filled telescopes [10] or the like therefore cannot but have a null result.

The same principle applies for the source. As for any wave, movement of source is irrelevant for the wave front that was emitted at one time. If emitted waves were dragged by the source star, the influence would be again vanishingly because of the comparably very short distance that light might be dragged by gravity of source. **The reverse argument though is, that light entrained by gravity still effects stellar aberration and entrained ether remains fully suitable to explain stellar aberration.**

As well the lack of any observable terrestrial aberration is self- explanatory based on the gravity entrained ether concept. Though light speed does not depend on source's movement, light will be entrained by gravity and the ether will not have any relative speed against the observer. Therefore no differing light speed will be measurable by the observer on earth, nor terrestrial aberration can exist.

2. Static ether: Sagnac effect, Michelson/Gale/Pearson and Michelson/Morley Experiment

Again to put things in order, it is necessary to compare the circumstances and all velocities that are relevant for each of the experiment setups, and have a model for clarification. For convenience it is assumed in the first step that the Michelson/Gale/Pearson and the Sagnac experiments represent one and the same phenomenon. We further assume that merely two velocities are of importance: Earth's rotational speed and total speed of the setup against CMB. Orbital speed around sun will be irrelevant since both types of experiments only deal with utmost diurnal periods.

Usually the Michelson/Gale/Pearson experiment is interpreted to deal with earth's rotational speed only, which is not reasonable, since this speed is the smallest of all involved. We have to put this right, as per following figure:

- v is the velocity of earth's rotation on equator
- V is the total velocity of earth against CMB

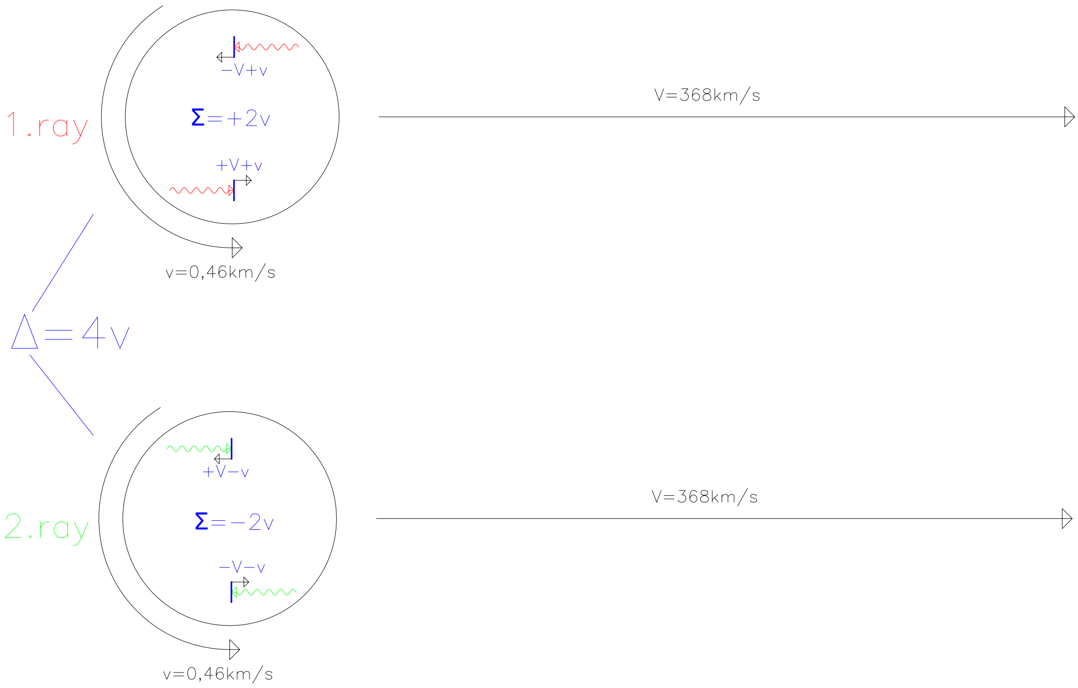

Fig. 12: Principle of Sagnac interferometer in static ether

Assuming one light ray circling around earth counterclockwise (red), we obtain for one cycle:

On ůKŜ dzLJLJŜŊ ăŜŎůϩyϒ

-VЪv

On the f2øŜℕ ăŜŎűλ2y:

+Vƀv

Adding up to ƀ2v. All additions of speed perpendicular to CMB speed are cancelling each other. V is shown to be cancelling out in general.

For the second ray (clockwise, green):

On the dzLJLJŜℕ ăŜŎűλ2y:

ƀVπv

On the f2øŜℕ ăŜŎűλ2y:

πVπv

Adding up to π2v. V again is cancelling out.

¢KŜ ŘλŦŦŜℕŜyŎŜ Ŧ2ℕ ō2ůK ℕIˑèă y2ø λă:

+2v-(-2v)= 4v

The result of Michelson/Gale/Pearson effect is esteemed to be in accordance with static ether and to show the difference of light travel distances due to the movement of the observer towards one or the opposite direction against the light ray. Even taken into consideration the total speed of 368 km/s towards the CMB, the result would remain the same, because this much higher speed is cancelling out on the light pathes, as been shown. A roundtrip route of the two light rays is required for this cancellation and consequently both rays will have to enclose an area. The measurable effect is of first order on v/c. The Sagnac effect is explainable just the same way, indeed is the same effect.

Now the analogues consideration regarding the Michelson/Morley experiment:

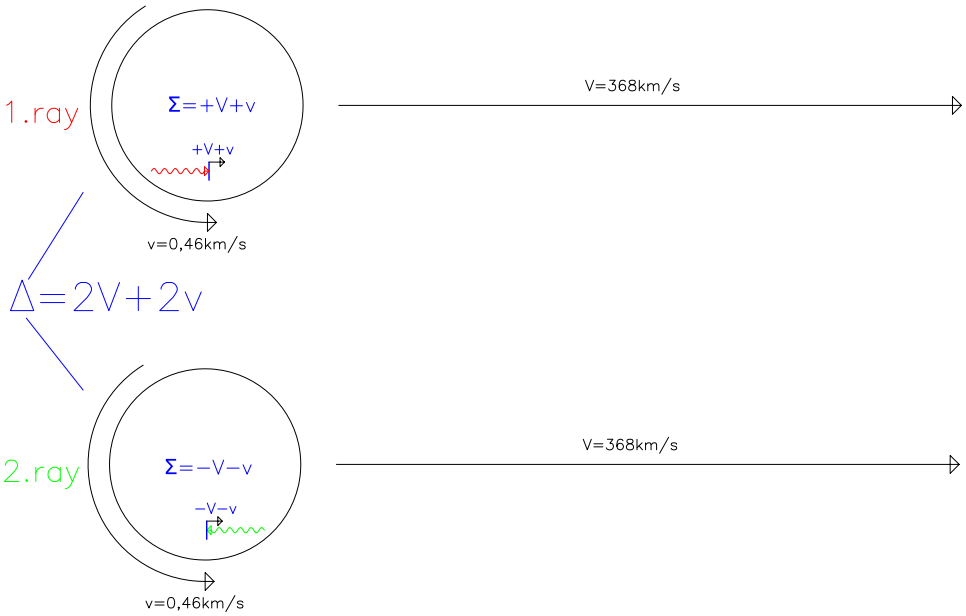

Fig. 13: Principle of Michelson/Morley interferometer in static ether

First ray in direction of CMB (red), we obtain:

ƀVƀv

For the second ray against direction of CMB (green):

ɪVɪv

The difference of both rays now is:

+V+v-(-V)-(-v) = 2V+2v

As can be seen, the total speed against CMB is not cancelling out but adding up! Merely due to the fact that only second order effects on v^2/c^2 are measurable with the Michelson/Morley setup, the result remains tiny. The original experiment dealt with only earth's orbital speed of approx. 30 km/s instead of 368 km/s, and already predicted a positive result of travel length distance for both rays resulting in $4x10^{-2}$ of a wavelength. Assuming 368 km/s the difference would be even 4 times a wavelength, and even more the null result becomes distinct. If it was possible to measure the total speed against CMB with a first order effect, difference would be gigantic, and it feels reasonable, that no compensation other than a fundamentally new approach could explain the null result.

3. Entrained ether: Sagnac effect, Michelson/Gale/Pearson and Michelson/Morley Experiment

Now we draw the equivalent pictures based on the assumption that light is being entrained by gravity:

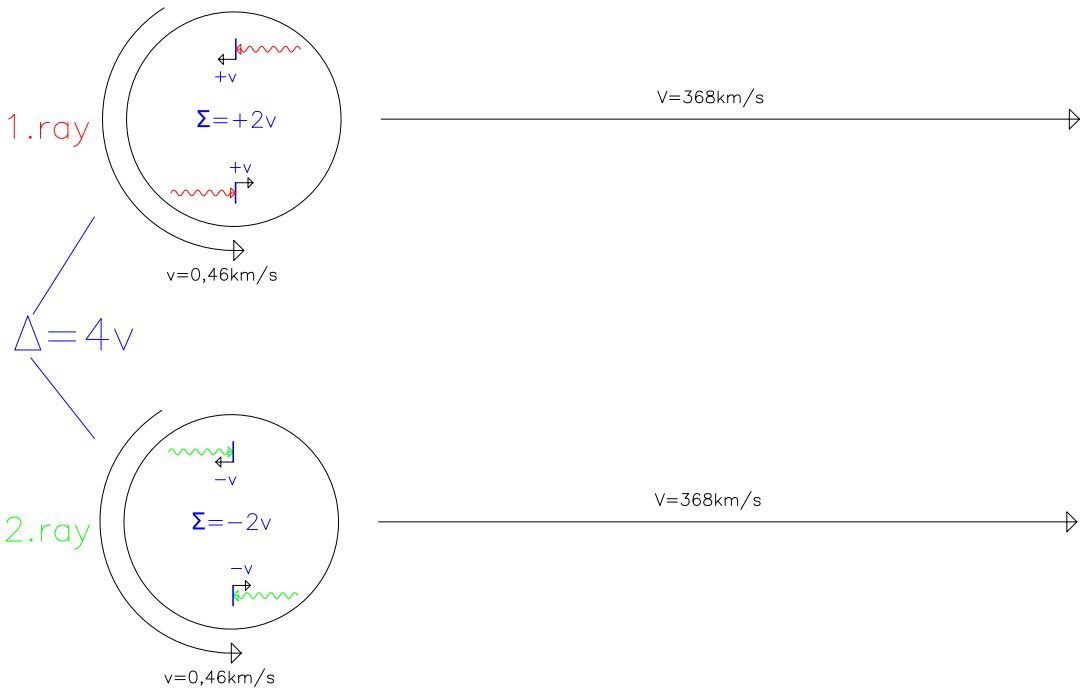

Fig. 14: Principle of Sagnac interferometer in entrained ether

We obtain the same situation as per static ether, i.e. difference amounts to 4v, but for different reason. Total speed against CMB is not cancelling out, but does not account at all since light is fully dragged by earth's

gravity, and only rotational speed on earth's surface is playing a role. Therefore the difference of light propagation distances due to the movement of the observer on the rotating earth towards one or the opposite direction of the light rays is still existing and in accordance with experiment.

One might say now since centrifugal force is negligable that this holds good for the Michelson/Gale/Pearson experiment, but in case of the Sagnac effect, centrifugal force on the rotating disc could become easily stronger than gravity, both light rays would be accelerated and glued to the disc's rim, and the Sagnac experiment would have to give a null result. This is the one and only argument claiming to disprove entrained ether on basis of Sagnac and Michelson/Gale/Pearson type experiments, but the deepest of all misinterpretations:

Centrifugal force is a furious force and needs a physical bonding between the rotating surface and the body that is to be accelerated. This would be the case for someone standing on the earth or on the rotating disc, but not for the light. There is no reason why light should be accelerated by a rotating body unless having a physical bonding to it. Even considering the Michelson/Gale/Pearson situation it is not plausible that light should be accelerated with the rotating surface of earth. There is no bonding except the irrelevant earth's atmosphere. **Therefore Sagnac effect and Michelson/Gale/Pearson experiment do not disagree with gravity entrained ether.**

Now finally we come to the Michelson/Morley experiment under the same assumption:

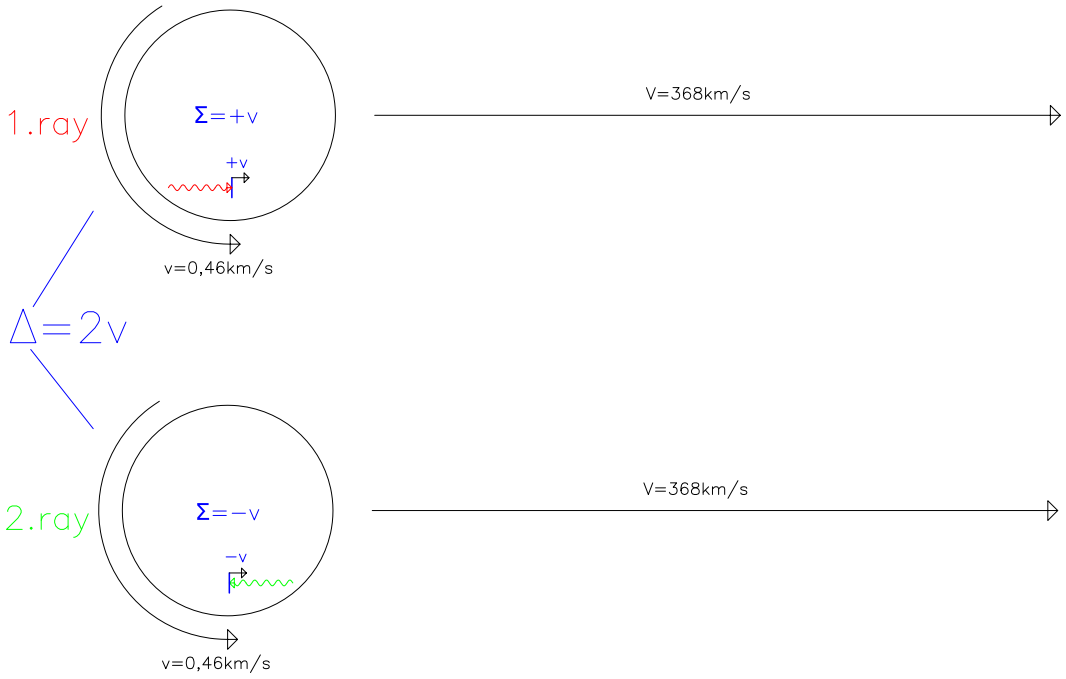

Fig. 15: Principle of Michelson/Morley interferometer in entrained ether

Differently from the static ether, also in this case total speed against CMB does not account. The experiment now is dealing with only more the second order effect of earth's rotational speed. The difference of light travel distances would be only in the range of 10^{-6} of a wavelength, equivalent to a difference of light speed of 0,1 mm/s, and the most accurate interferometer experiments give not less than 10^{-4} of a wavelength! **Therefore also the Michelson/Morley experiment is well explainable by gravity entrained ether.**

4. More empiric evidence esteemed to disprove entrained ether

The Hammar experiment with a setup consisting of differing length interferometer arms partially cladded with heavy lead blocks also gave a null result, although, under the terms of entrained ether, a positive result was expected due to gravitational attraction of light by the blocks. The obtained null result is everything but significant. It is completely implausible why any lightray that is already fully entrained by gravity, should be even more than fully entrained by additional gravity. Also arguments of the sort that mass and gravity of the rotating disc of Sagnac type experiments could influence the light propagation are irrelevant for the same reason, and additionally gravity is confused with centrifugal force, as if gravity would be somehow rotating together with the disc's motion.

5. Conclusion and Perspective

We have seen that understanding of the nature of light propagation is until today underlying some fundamental misinterpretations that we brought into order with this paper. In fact there is no reason why light should not be entrained by gravity in general, at least on the foundation of the above discussed experiments, and Special Relativity [1] can be obsolete. Further investigations will have to be accomplished on experiments dealing with laser resonator setups and frequency comparison and have to be revised under terms of gravity entrained ether.

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