A Modified Michelson-Morley Experiment

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Abstract

The small fringe shifts observed in the Michelson-Morley (MM) experiments are dismissed by mainstream physicists as experimental artifacts. However, this interpretation is increasingly being challenged. Based on a new insight, simple and modified MM experiments are proposed that should give much larger fringe shifts, typically more than sixty fringe shifts. The mystery to increase the sensitivity of the conventional MM experiment is to slightly adjust the angular positions and the distances of the beam splitter and/or the mirrors so that the angle between the longitudinal light beam and the transverse light beam at the source is as large as possible, say 10^{-2} radians. This angle is very small in conventional MM experiments, making the experiments insensitive to absolute motion. Conventional theories such as ether theory and special relativity consider a single beam up to the beam splitter. The new theory, called Apparent Source Theory, has the potential to consistently explain many of the previously enigmatic and controversial light speed experiments. However, getting a non-mainstream theory accepted is a major challenge in physics today. The only way to possibly convince the scientific community is to test and confirm a unique prediction of the theory.

Introduction

The 'null' result of the Michelson-Morley (MM) experiment is the basis of the theory of relativity. Despite the popular view, however, this interpretation is increasingly being challenged. A number of other experiments have shown that the notion of absolute motion may still be valid. I claim to have gained a new insight that may have eluded physicists so far. The new theory, called Apparent Source Theory[1][2][3], has the potential to consistently explain many of the previously enigmatic and controversial light speed experiments. However, getting a non-mainstream theory accepted is a major challenge in physics today. The only way to possibly convince the scientific community is to test and confirm a unique prediction of the theory. I propose new experiments that may be many orders more sensitive than conventional MM experiments. One is a simple experiment requiring only a laser pointer, a mirror and a detecting screen. The others are modified MM experiments in which the distances and angular positions of the beam splitter and/or the mirrors are changed from their conventional positions.

New modified Michelson-Morley experiment

Consider the experimental setup shown in Fig.1 .With zero absolute velocity, the source position is at S. Two light rays originate from S, a direct (blue) ray and reflected (red) ray, and meet at O to create an interference pattern. The line connecting points S and O is a vertical line.

Since angle of incidence is equal to angle of reflection:

$$\frac{d}{\sqrt{(L-h)^2+d^2}} = \frac{d}{\sqrt{h^2+d^2}}$$

Given L and d, h can be determined from the above equation.

The path length of the (reflected) red light ray is:

$$\sqrt{(L-h)^2+d^2} \ + \ \sqrt{h^2+d^2}$$

The path length of the (direct) blue ray is L .

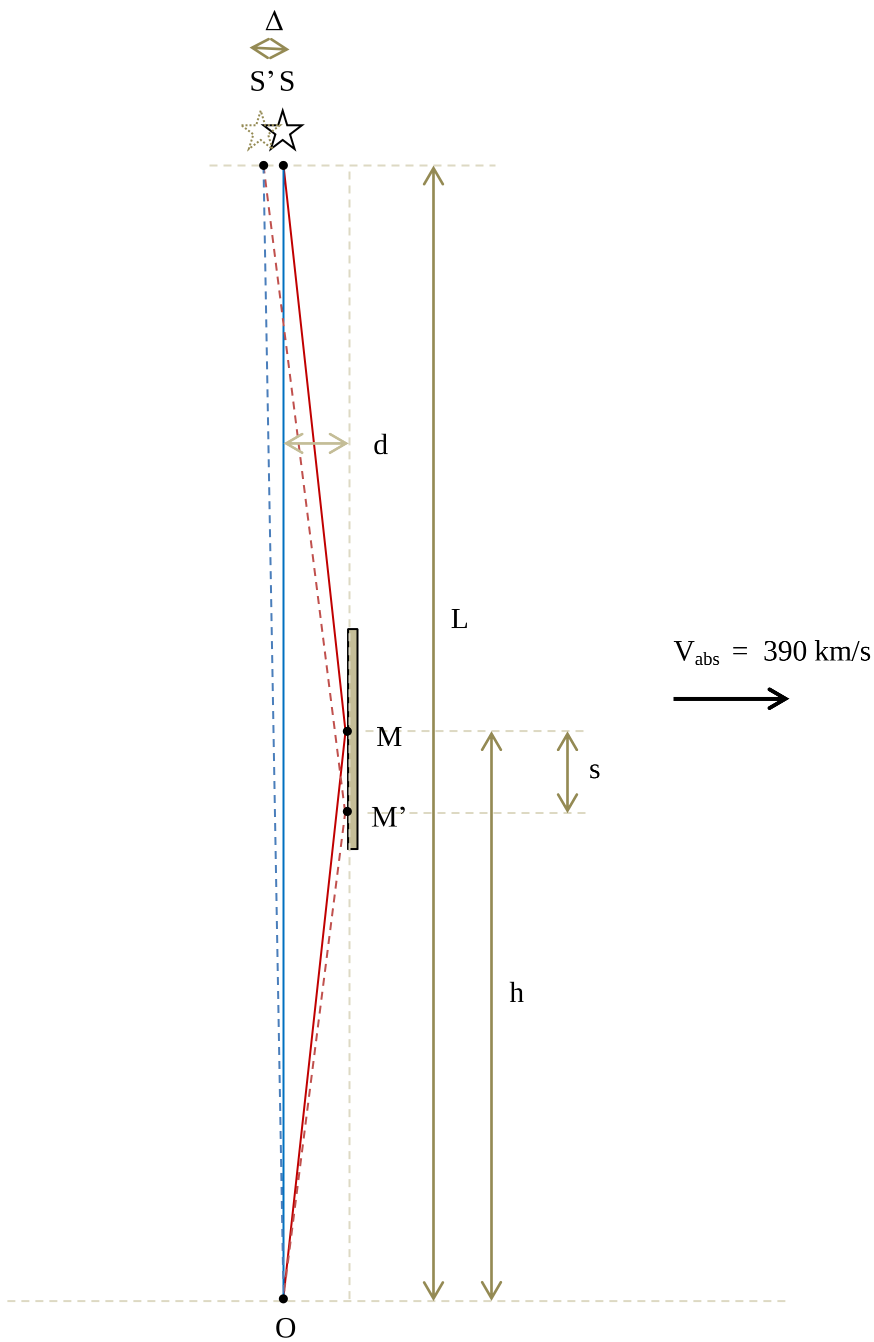


Fig. 1

The difference between the path lengths of the direct ray (blue) and the reflected ray (red) will be:

$$\delta_1 = \sqrt{(L-h)^2 + d^2} + \sqrt{h^2 + d^2} - L$$

When the apparatus is in absolute motion, the apparent position of the light source (as seen from point O) will be S'. Virtual light rays will originate from S' and meet at O, one directly from S' (blue broken ray) and the other reflected from the mirror at point M' (red broken ray).

Since angle of incidence is equal to angle of reflection:

$$\frac{d + \Delta}{\sqrt{(L - h + s)^2 + (d + \Delta)^2}} = \frac{d}{\sqrt{d^2 + (h - s)^2}}$$

Given L, d, Δ and h, s can be determined from the above equation.

The path length of the red broken ray will be:

$$\sqrt{(L - h + s)^2 + (d + \Delta)^2} + \sqrt{(h - s)^2 + d^2}$$

The path length of the (broken) blue ray will be:

$$\sqrt{L^2 + \Delta^2}$$

The difference between the path lengths of the reflected ray (red) and direct ray (blue) and will be:

$$\delta_2 = \sqrt{(L - h + s)^2 + (d + \Delta)^2} + \sqrt{(h - s)^2 + d^2} - \sqrt{L^2 + \Delta^2}$$

The fringe shift is obtained from :

$$\text{fringe shift} = \frac{\delta_2 - \delta_1}{\lambda}$$

where λ is the wave length of the light used.

Let λ = 600 nm, L = 2 m and d = 0.02 m. Using Excel I obtained, h = 1 m and δ_1 = 0.00039996 m .

Let Δ = 0.0026m. This is the apparent change in position of the source due to absolute motion (390 km/s).

From L, d, h and Δ, I obtained s = 0.061036 m and δ_2 = 0.000451949 m

The fringe shift will be:

$$\text{fringe shift} = \frac{\delta_2 - \delta_1}{\lambda} = \frac{0.000451949 \text{ m} - 0.00039996 \text{ m}}{600\, nm} = \frac{51988.5\, nm}{600\, nm} = \boldsymbol{86.64\, fringes}$$

This is many orders greater than the fringe shifts observed in the Miller experiments.

Reducing d by a factor of ten reduces the fringe shift by the same factor. Therefore, for d = 0.002 m , the fringe shift would be 8.664 fringes. This is the mystery behind the 'null' results of MM experiments.

Modified Michelson-Morley experiment

Now let us see how we can directly modify the conventional Michelson-Morley experiment to make it more sensitive.

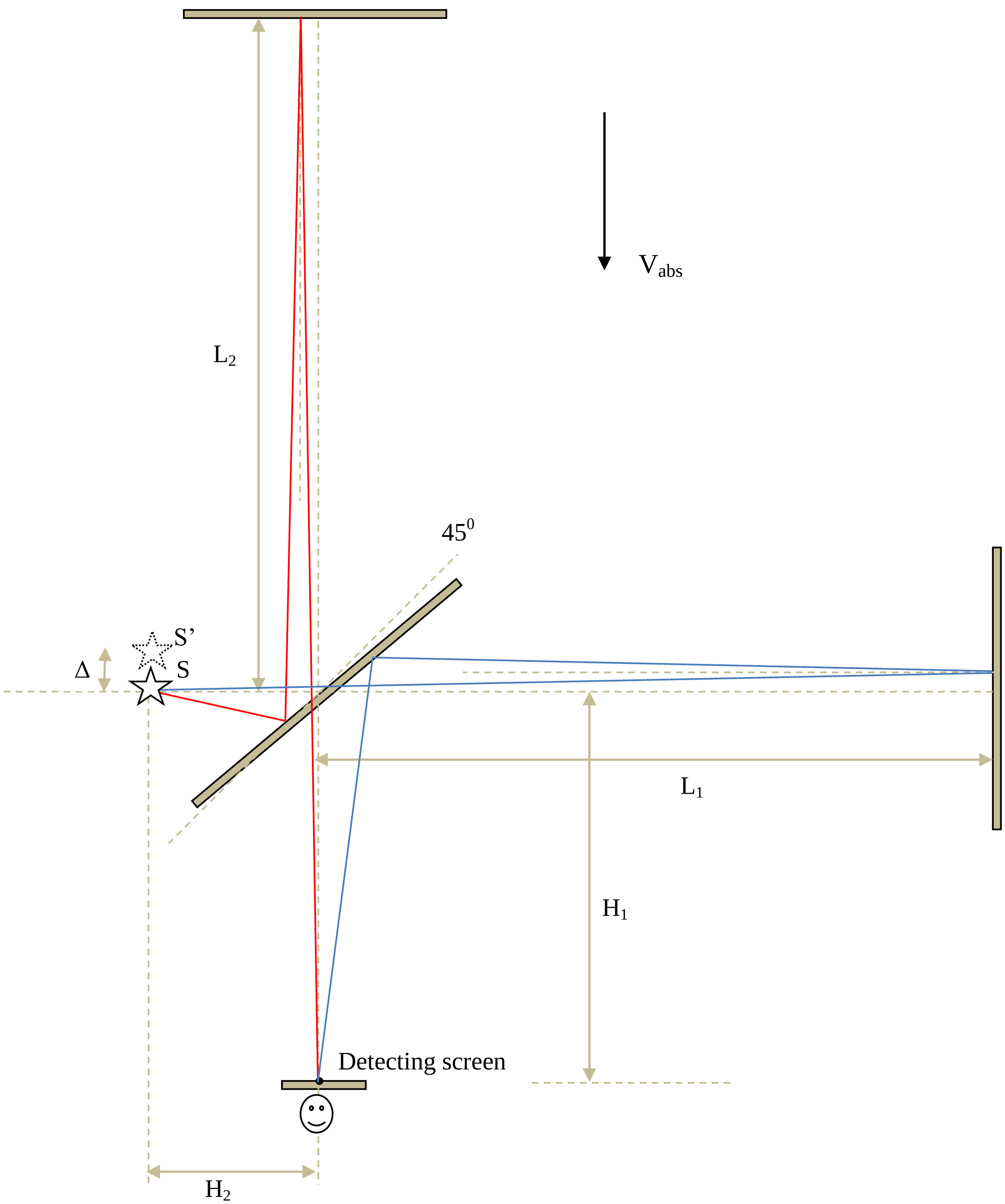


Fig. 2

Unlike the conventional MM experiment, the beam splitter is slightly tilted down to an angle less than 45 degrees. *The mystery is to rearrange the distances and (angular) positions of the beam splitter and/or the mirrors so that the angle between the longitudinal light beam (red) and the transverse light beam (blue) at the source is as large as possible, say 10^{-3} or 10^{-2} radians*. To simplify the analysis, we can modify the angle of the beam splitter only, as long as we get a large enough angle between the two beams at the source.

The new finding in this paper is that a Michelson-Morley experiment with the beam splitter exactly at 45 degrees, and the longitudinal mirror at exactly vertical and the transverse mirror exactly horizontal will give a *complete* null result. The only way to get a fringe shift is to modify the MM interferometer by changing the angle of the beam splitter and/or the mirrors. The small fringe shifts observed in the Miller experiments can be explained by the fact that the mirrors are slightly tilted to get straight fringes. Michelson and Miller slightly tilted the mirrors only to change the fringes from circular to straight, and unknowingly increased the sensitivity of the apparatus to absolute motion, not because they understood the mystery that tilting the mirrors would increase the sensitivity.

In my paper[3], due to simple mistakes [4] I made in two of the equations, I got the wrong result that an MM apparatus would give small fringe shifts even with the beam splitter at 45 degrees and with the mirrors in exactly vertical and horizontal positions.

So the mystery that has eluded physicists so far is that the MM apparatus should be modified in such a way that the angle between the two light beams at the source is as large as possible, for an apparatus at absolute rest, to make the interferometer sensitive to absolute motion. If the angle between the two beams is large enough at the source while the apparatus is still at absolute rest, then there will be a large fringe shift when the apparatus is set in absolute motion. If the angle between the two beams at the source is zero (or very small) with the apparatus at absolute rest, then there will be no (significant) fringe shift with the apparatus set in absolute motion.

Conventional analyses based on ether theory and special relativity have no idea about this angle. Both (wrongly) assume a single light beam up to the beam splitter and assume that the two light beams are created at the beam splitter. According to Apparent Source Theory, on the contrary, the longitudinal and transverse light beams each originate at the (apparent) source, not at the beam splitter, hence angle between the longitudinal and transverse light beams at the source.

The quantitative analysis of the modified MM experiment is involved, but is a straightforward geometrical optics problem, as shown in my paper[3]. In this paper, I will present a complete analysis of a modified Michelson-Morley experiment that is many orders of magnitude more sensitive than the conventional MM experiments.

As I pointed out above, the Michelson-Morley interferometer should be modified so that the two light beams (the longitudinal and the transverse beams) form a relatively large angle at the source. This can be done by adjusting the angle of the beam splitter to an angle slightly less than 45 degrees, say 44 degrees. The beam splitter angle is adjusted so that the two beams form a relatively large angle at the source while the apparatus is at absolute rest. This will increase the sensitivity of the apparatus to absolute motion. The flaw that has eluded physicists for centuries is that in conventional MM experiments the two beams form nearly zero angle at the source, and this made the apparatus almost insensitive to absolute motion. The flaw is ultimately connected to 'ether thinking'. The 'ether thinking' pervaded the physicists' thinking even when they claimed that they disproved the ether.

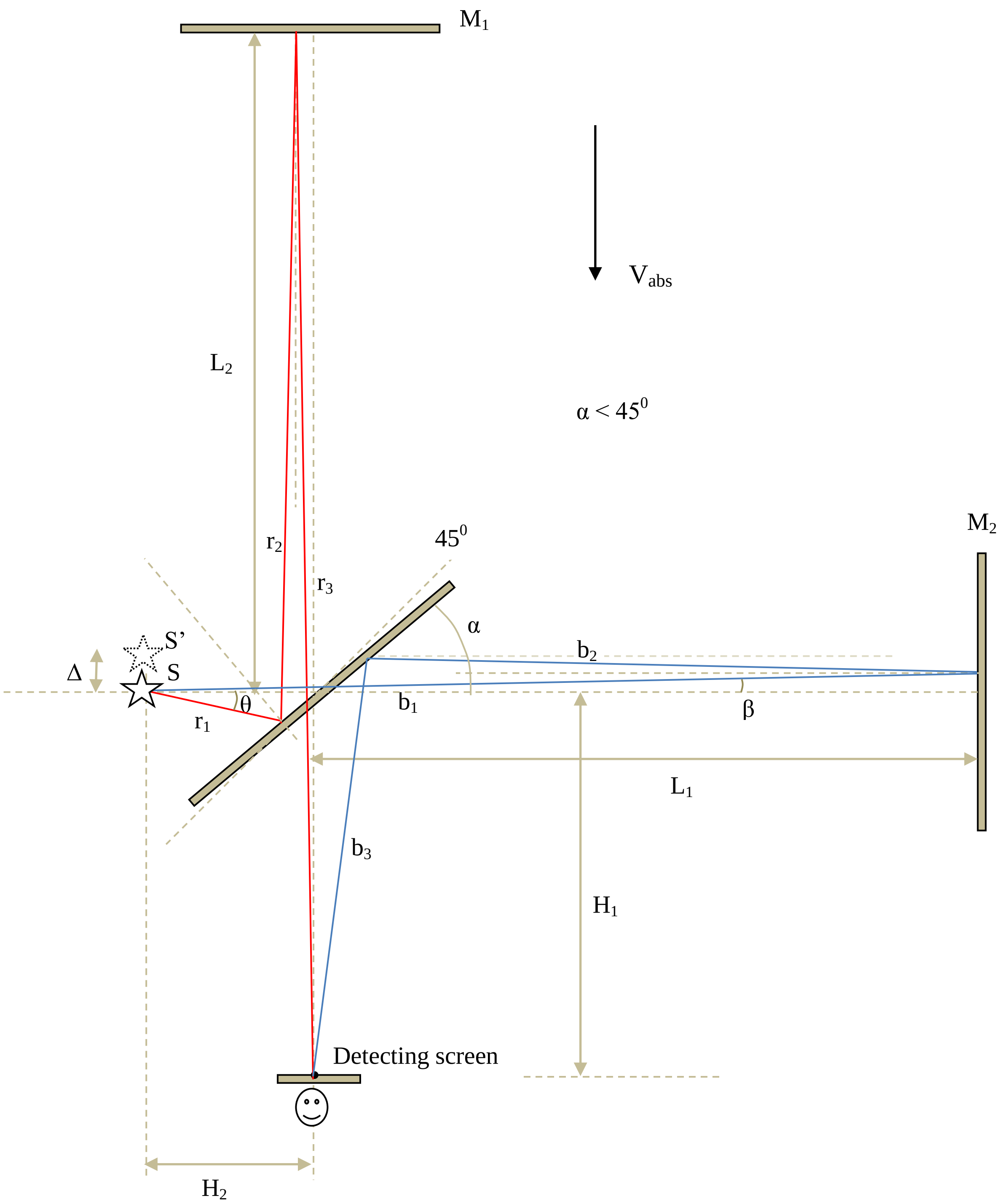
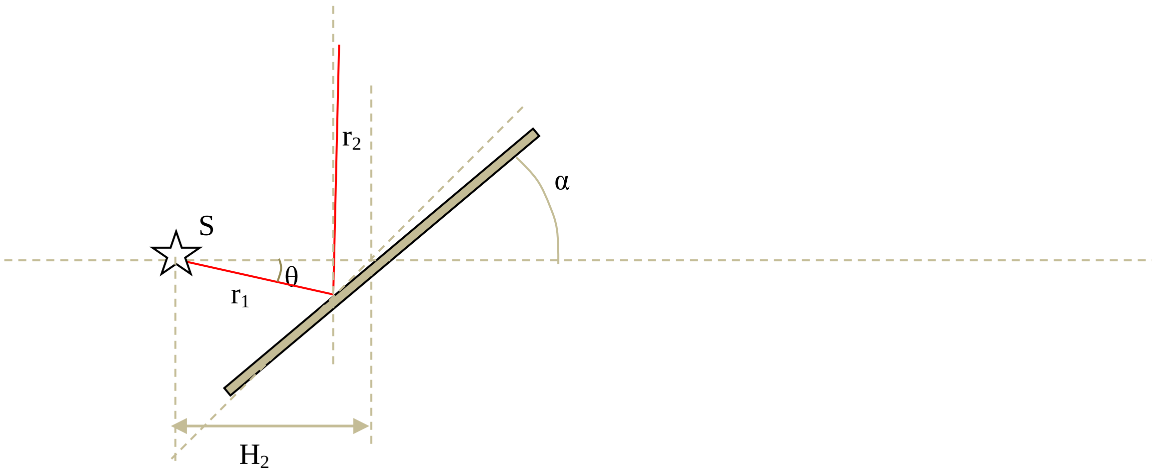


Fig. 3

Interferometer at rest



The angle between the beam splitter and r_1 (also r_2) is:

$$\theta + \alpha$$

The (red) light beam, the beam splitter and the horizontal line form an angle, as shown above.

$$\frac{\sin\alpha}{r_1} = \frac{\sin(180^0 - \theta - \alpha)}{H_2}$$

$$\Longrightarrow \; r_1 = \frac{H_2 \sin\alpha}{\sin(180^0 - \theta - \alpha)}$$

The horizontal component of r_1 is:

$$r_1 \cos\theta$$

The angle between r_2 and the vertical is:

$$(90^0 - \alpha) - (\theta + \alpha) = 90^0 - (\theta + 2\alpha)$$

The horizontal component of r_2 is:

$$(r_1 \sin\theta + L_2) \tan(90^0 - (\theta + 2\alpha))$$

The horizontal component of r_3 :

$$(L_2 + H_1) \tan(90^0 - (\theta + 2\alpha))$$

The sum of the horizontal components of r_1, r_2 and r_3 is equal to H_2 :

$$r_1 \cos\theta + (r_1 \sin\theta + L_2) \tan(90^0 - (\theta + 2\alpha)) + (L_2 + H_1) \tan(90^0 - (\theta + 2\alpha)) = H_2$$

But

$$\frac{L_2 + r_1 \sin\theta}{r_2} = \cos(90^0 - (\theta + 2\alpha))$$

$$\Longrightarrow \quad r_2 = \frac{L_2 + r_1 \sin\theta}{\cos(90^0 - (\theta + 2\alpha))}$$

Also

$$\frac{L_2 + H_1}{r_3} = \cos(90^0 - (\theta + 2\alpha))$$

$$\Longrightarrow \quad r_3 = \frac{L_2 + H_1}{\cos(90^0 - (\theta + 2\alpha))}$$

Ray b_2 (also ray b_3) makes an angle of:

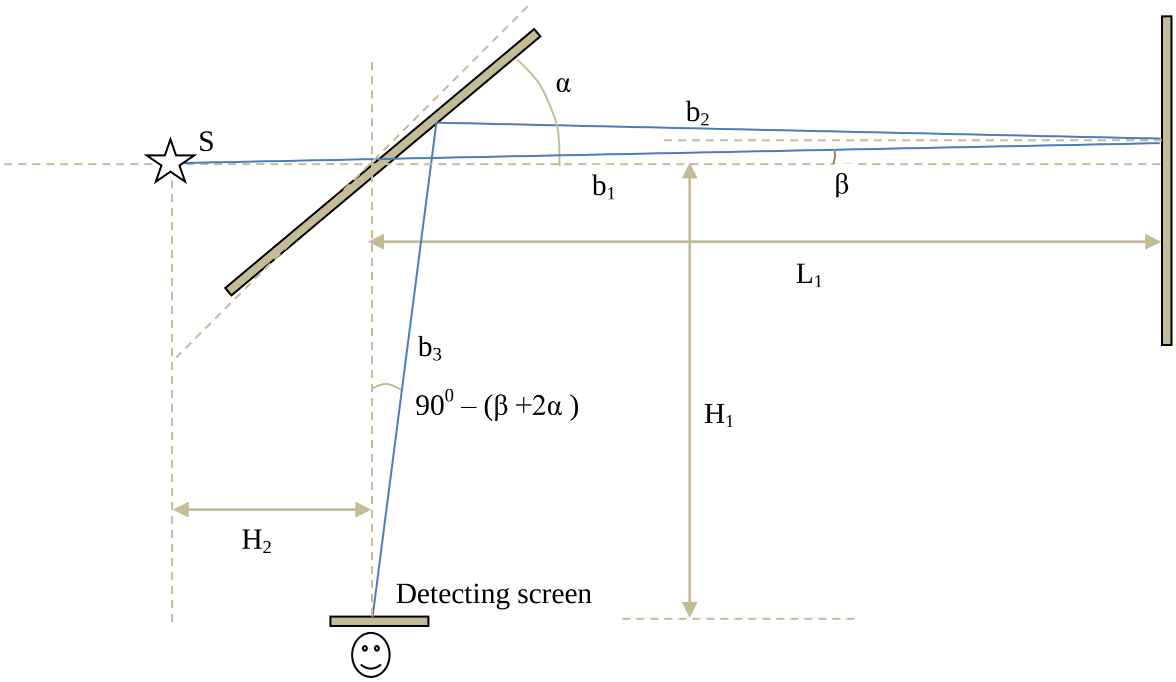
$$\alpha + \beta$$

with the beam splitter.

Ray b_3 makes an angle of:

$$180^0 - ((\alpha + 90^0) + (\alpha + \beta)) = 90^0 - (\beta + 2\alpha)$$

with the vertical, as shown in the next figure.



Ray b_3 , the vertical line and the beam splitter form a triangle, from which:

$$\frac{\sin(90^0 + \alpha)}{b_3} = \frac{\sin(\alpha + \beta)}{H_1}$$

$$\Longrightarrow b_3 = \frac{H_1 \sin(90^0 + \alpha)}{\sin(\alpha + \beta)}$$

The vertical component of b_3 is equal to the sum of H_1 , the vertical component of b_1, the vertical component of b_2 .

$$b_3 \cos(90^0 - (\beta + 2\alpha)) = H_1 + (H_2 + L_1)\tan\beta + (L_1 - b_3 \sin(90^0 - (\beta + 2\alpha)))\tan\beta$$

But

$$\frac{H_2 + \ L_1}{b_1} \ = \ \cos\beta$$

$$\Longrightarrow \ b_1 \ = \frac{H_2 + \ L_1}{\cos\beta}$$

Also

$$\frac{L_1 - \ b_3 \ \sin\ (\ 90^0 \ - \ (\ \beta + 2\alpha\ )\ \ )}{b_2} \ = \cos\beta$$

$$\Longrightarrow \ b_2 \ = \ \frac{L_1 - \ b_3 \ \sin\ (\ 90^0 \ - \ (\ \beta + 2\alpha\ )\ \ )}{\cos\beta}$$

<u>Interferometer in absolute motion</u>

In this case the light is assumed to start from S'. We only need to modify the above equations, whenever necessary.

$$\frac{\sin\alpha}{r_1} \ = \ \frac{\sin(180^0 - \ \theta - \ \alpha)}{H_2 \ \ + \ \dfrac{\Delta}{\tan\alpha}}$$

$$\Longrightarrow \ r_1 \ = \frac{(\ \sin\alpha\ )\ (\ H_2 + \ \dfrac{\Delta}{\tan\alpha}\ )}{\sin(180^0 - \ \theta - \ \alpha)} \ = \ \frac{H_2 \ \sin\alpha \ + \ \Delta\cos\alpha}{\sin(180^0 - \ \theta - \ \alpha)}$$

In the figure below, the rays from S (for apparatus at absolute rest) are shown in gray for comparison. Note that the drawing is only qualitative, and is not meant to be precise.

θ is the angle between the red beam r_1 originating from S' and the horizontal. β is the angle between the blue beam b_1 originating from S' and the horizontal (not shown in the figure because too small). Note that r_1 is below the horizontal and b_1 is above the horizontal.

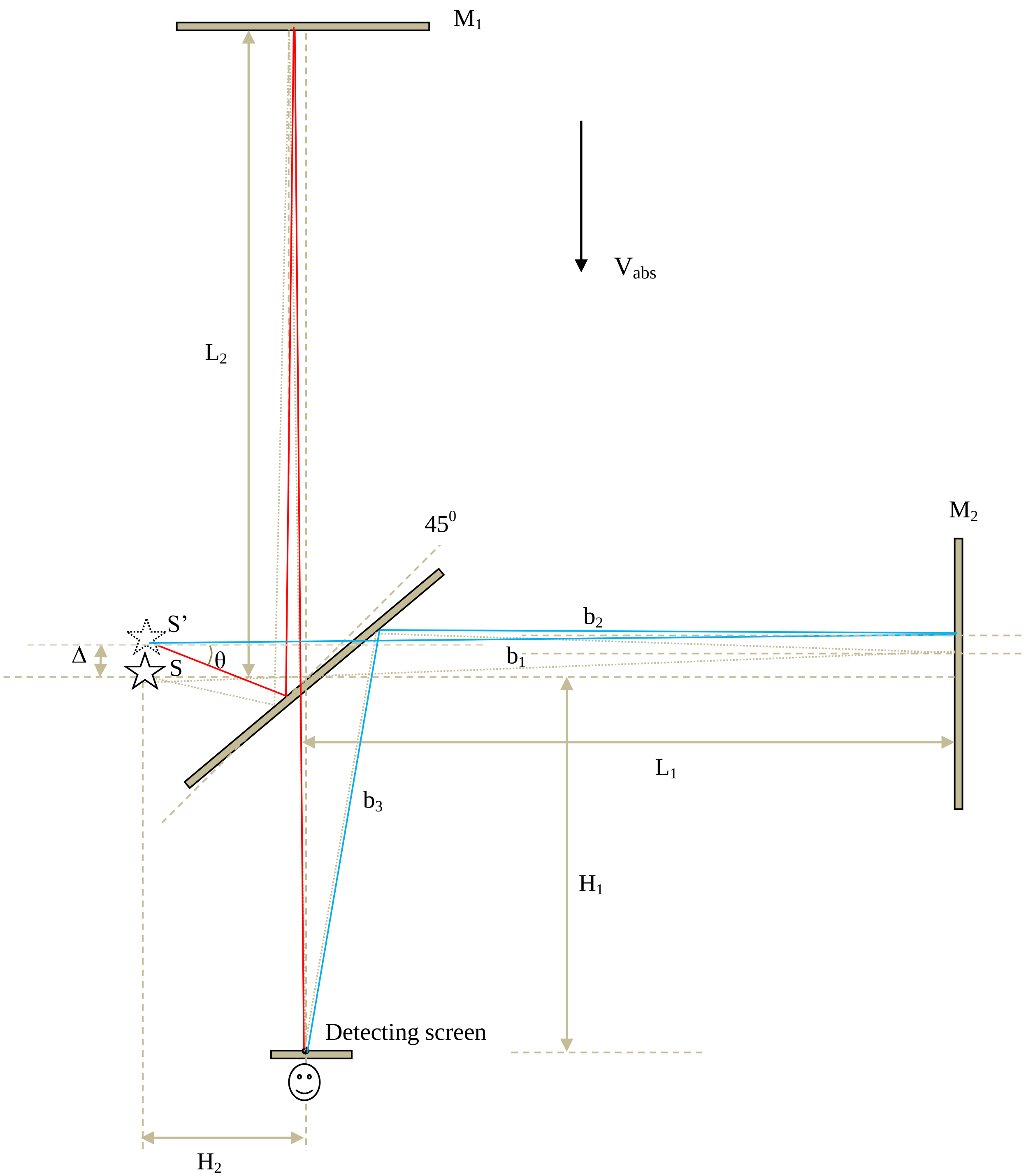


Fig. 4

The horizontal component of r_1 is:

$$r_1 \cos\theta$$

The horizontal component of r_2 is:

$$(\ r_1 \sin\theta - \Delta + L_2\ )\ \tan(90^0 - (\theta + 2\alpha))$$

The horizontal component of r_3 :

$$(\ L_2 + H_1\ )\ \tan(90^0 - (\theta + 2\alpha))$$

The sum of the horizontal components of r_1, r_2 and r_3 is equal to H_2 :

$$r_1 \cos\theta + (\ r_1 \sin\theta - \Delta + L_2\ )\ \tan(90^0 - (\theta + 2\alpha)) + (\ L_2 + H_1\ )\ \tan(90^0 - (\theta + 2\alpha)) = H_2$$

But

$$\frac{L_2 + r_1 \sin\theta - \Delta}{r_2} = \cos\ (90^0 - (\theta + 2\alpha))$$

$$\Rightarrow \quad r_2 = \frac{L_2 + r_1 \sin\theta - \Delta}{\cos\ (90^0 - (\theta + 2\alpha))}$$

Also

$$\frac{L_2 + H_1}{r_3} = \cos\ (90^0 - (\theta + 2\alpha))$$

$$\Rightarrow \quad r_3 = \frac{L_2 + H_1}{\cos\ (90^0 - (\theta + 2\alpha))}$$

Ray b_3 , the beam splitter and the vertical line form a triangle.

$$\frac{\sin(90^0 \ + \ \alpha\,)}{b_3} \ = \ \frac{\sin(\,\alpha \ + \ \beta)}{H_1}$$

$$\Longrightarrow \ b_3 \ = \ \frac{H_1 \ \sin(90^0 \ + \ \alpha\,)}{\sin(\,\alpha \ + \ \beta)}$$

The vertical component of b_3 is equal to the sum of H_1 , Δ, the vertical component of b_1, the vertical component of b_2 .

$$b_3 \ \cos\ (\,90^0 - (\,\beta + 2\alpha\,)\,) = H_1 \ + \Delta + (\,H_2 \ + \ L_1\,) \tan\beta \ + (\,L_1 - \ b_3 \sin\big(\,90^0 - \ (\,\beta + 2\alpha\,)\big)) \tan\ \beta$$

Also

$$\frac{H_2 + \ L_1}{b_1} \ = \cos\beta$$

$$\Longrightarrow \ b_1 \ = \frac{H_2 + \ L_1}{\cos\beta}$$

and

$$\frac{L_1 - \ b_3 \ \sin\ (\,90^0 \ - \ (\ \beta + 2\alpha\,)\ )}{b_2} \ = \cos\beta$$

$$\Longrightarrow \ b_2 \ = \ \frac{L_1 - \ b_3 \ \sin\ (\,90^0 \ - \ (\ \beta + 2\alpha\,)\ )}{\cos\beta}$$

Let $H_1 = H_2 = 0.2$ m , $L_1 = L_2 = 1$m , $\alpha = 44^0$

First we compute the path difference (δ_1) for the case of the apparatus at rest ($V_{abs} = 0$ km/s).

Using Excel I obtained

$\theta = 0.031998154$ radians , $\beta = 0.0029084305$ radians

$r_1 = 0.193682557797135$ m , $r_2 = 1.006200682491940$ m , $r_3 = 1.200005075400560$ m

Total path length of red beam will be:

$$Total\ path\ length\ of\ red\ beam\ = r_1 + r_2 + r_3 = 2.39988831568963\ m$$

and

$b_1 = 1.200005075398670$ m , $b_2 = 0.993398188388834$ m , $b_3 = 0.206485051898358$ m

$$Total\ path\ length\ of\ blue\ beam\ = b_1 + b_2 + b_3 = 2.399888315685860\ m$$

The path difference at $V_{abs} = 0$ km/s will be:

$$\delta_1 = Path\ difference\ at\ = 2.39988831568963\ m - 2.39988831568586\ m = 0.003769\ nm$$

Next we compute the path difference (δ_2) for the case of the apparatus in absolute motion ($V_{abs} = 390$ km/s).

The apparent change in position of the source is obtained from the formula [1][2][3]

$$\Delta \approx \frac{V_{abs}}{c}\ D$$

where D is the direct distance between the point source S and the point of observation O.

$$D = 0.2 * \sqrt{2} = 0.283\ m$$

The maximum absolute velocity is $V_{abs} = 390$ km/s.

Therefore,

$$\Delta = \frac{V_{abs}}{c}\ D = \frac{390}{300000} * 0.283\ m = 0.3677\ mm$$

Using Excel I obtained

$\theta = 0.03215125$ radians , $\beta = 0.00290843$ radians

$r_1 = 0.194022440487249$ m , $r_2 = 1.005873112028730$ m , $r_3 = 1.200004555137120$ m

Total path length of red beam will be:

$$Total\ path\ length\ of\ red\ beam\ =\ r_1 + r_2 + r_3 = 2.399900107653090\ m$$

and

b_1 = 1.200005075396930 m , b_2 = 0.993398188280799 m , b_3 = 0.206485052004649 m

$$Total\ path\ length\ of\ blue\ beam\ =\ b_1 + b_2 + b_3 = 2.399888315682380\ m$$

The path difference at V_{abs} = 390 km/s will be:

$$\delta_2 = Path\ difference = 2.399900107653090\ m - 2.399888315682380\ m = 11792\ nm$$

The fringe shift will be:

$$\boldsymbol{fringe\ shift = \frac{\delta_2 - \delta_1}{\lambda} = \frac{11792\ nm - 0.003769\ nm}{600\ nm} = 19.65\ fringes}$$

Expected fringe shifts for different values of H_1, H_2, L_1, L_2 and α are given in APPENDIX1. Fringe shifts as large as one thousand can be obtained. The only factor limiting the fringe shifts that can practically be observed is the coherence length and beam width of the light used.

In the above analysis we considered changing the angle of the beam splitter (α) and the dimensions H_1, H_2, L_1, L_2. Another possible modification of the MM experiment that may be easier to implement experimentally is to change the angle of the mirror M_1, with the beam splitter angle at 45 degrees, as shown in the next figure. The red and blue light paths are for the case of the interferometer at absolute rest. When the interferometer is in absolute motion, the apparent position of the source will be at S' and the light paths should be determined for this case (not shown). The analysis is even more involved than the above, but again it is a straightforward geometrical optics problem.

<u>Interferometer at absolute rest</u>

The source S, the beam splitter and the vertical line form a triangle.

$$\frac{\sin 45^0}{r_1} = \frac{\sin(135^0 - \theta)}{H_2}$$

$$\Rightarrow r_1 = \frac{H_2 \sin 45^0}{\sin(135^0 - \theta)}$$

It can be shown that ray r_1 (also ray r_2) makes an angle of ($\theta + 45^0$) with the beam splitter.

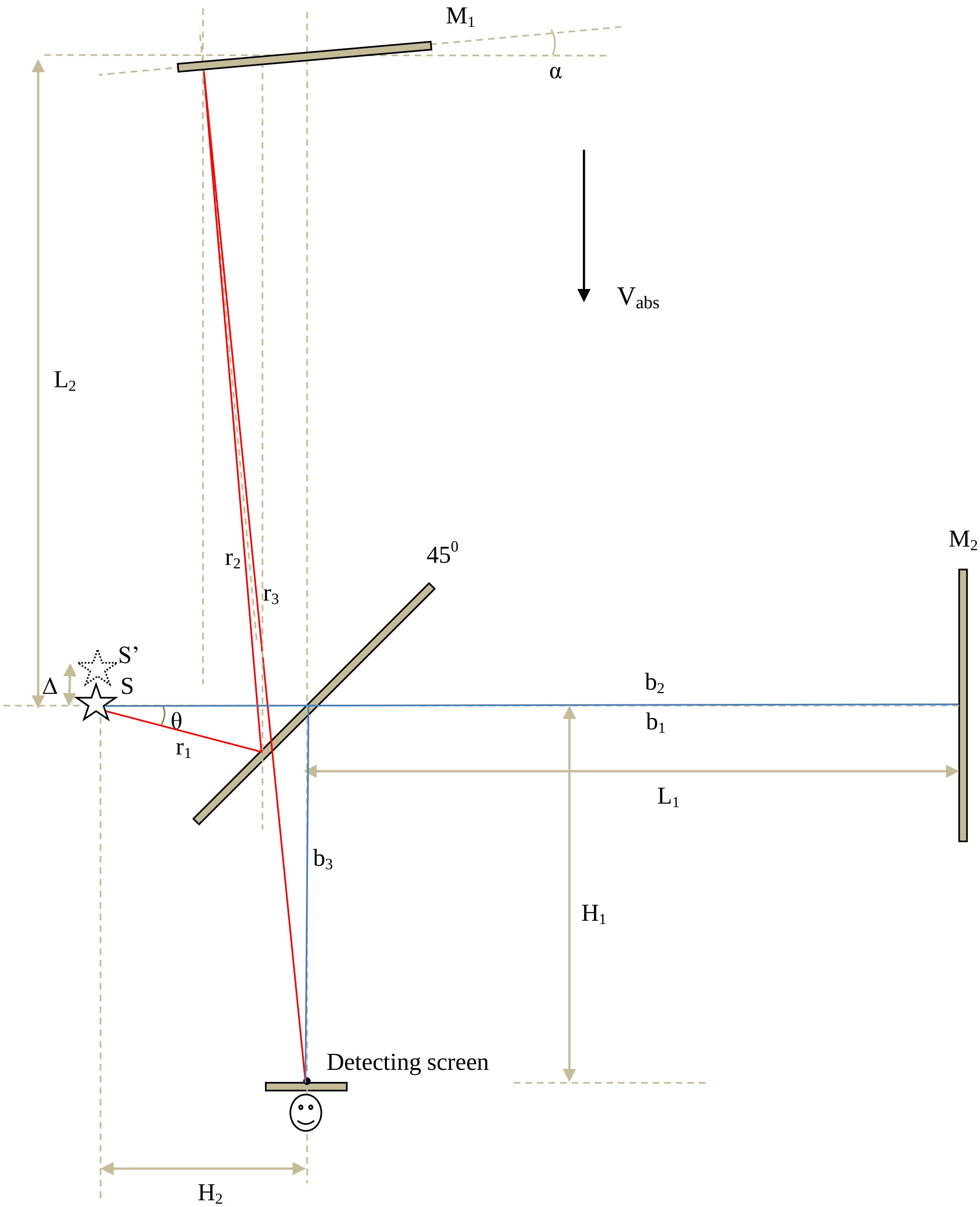
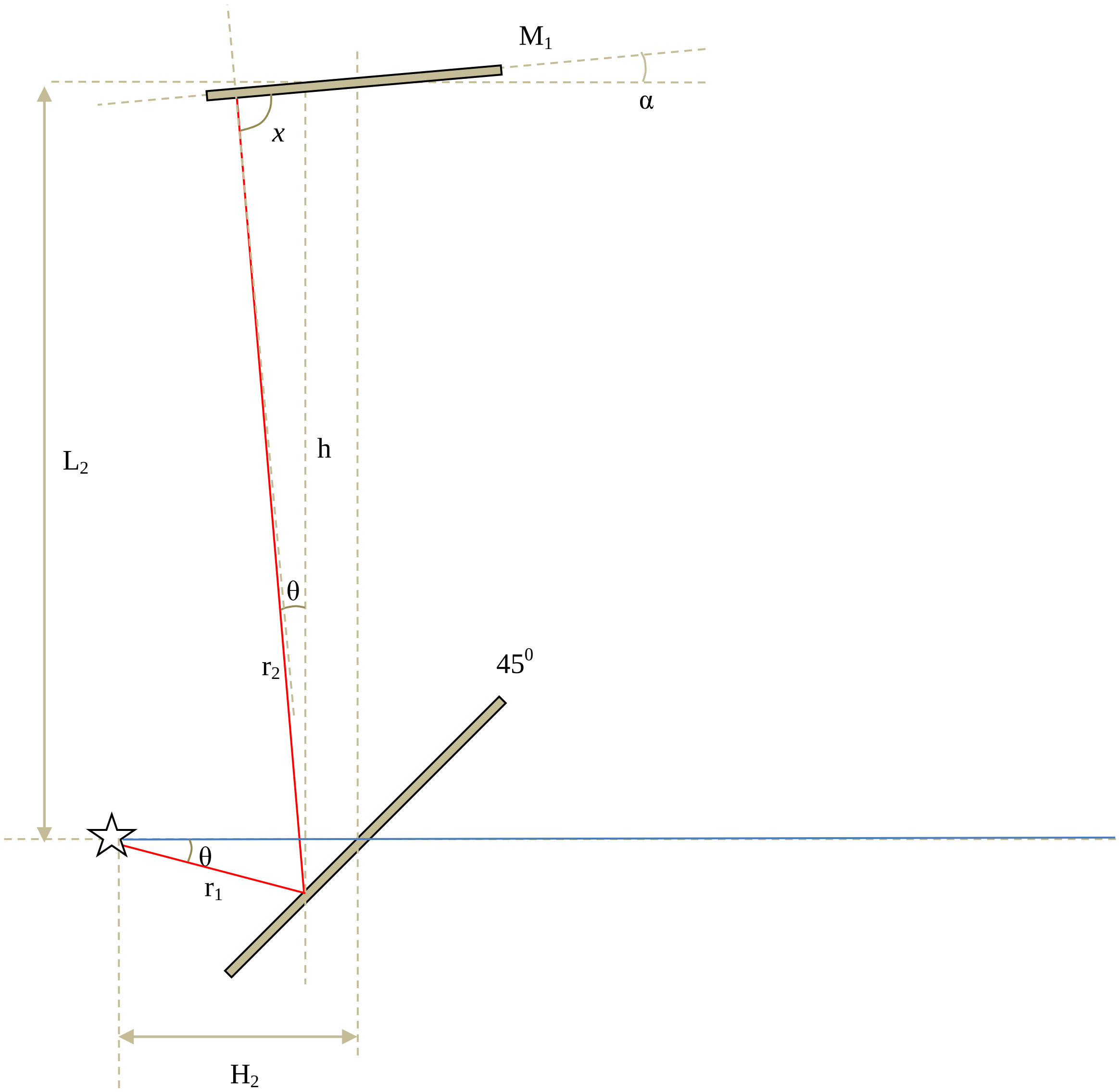

M1
α
Vabs
L2
r2
r3
45⁰
M2
S'
Δ
S
b2
θ
b1
r1
L1
b3
H1
Detecting screen
H2

Fig. 5

Therefore, ray r_2 makes an angle of:

$$(\theta + 45^0) - 45^0 = \theta$$

with the vertical.



The value of angle *x* can be shown to be :

$$x = (\alpha + \ 90^0\ ) - \ \theta$$

Ray r_2 , the mirror M_1 and the vertical line *h* form a triangle.

From the above diagram, the value of *h* (as a function of θ) can be shown to be:

$$h = \ r_1 \sin\theta \ + \ \ L_2 - \ (\ H_2 - \ r_1 \cos\theta\ )\ tan\ \alpha$$

From the relation:

$$\frac{\sin(90^0 - \ \ \alpha)}{r_2} = \frac{sin\ x}{h}$$

Substituting the expressions for *x* and *h* above:

$$\Longrightarrow \ \frac{sin(90^0 - \ \alpha\ )}{r_2} = \frac{sin\ ((\alpha + \ 90^0\ ) - \ \theta)}{r_1 \sin\theta \ + \ \ L_2 - \ (\ H_2 - \ r_1 \cos\theta\ )\ tan\ \alpha}$$

$$\Longrightarrow r_2 = \ \frac{(r_1 \sin\theta \ + \ \ L_2 - \ (\ H_2 - \ r_1 \cos\theta\ ) tan\ \alpha)\ sin(90^0 - \ \alpha\ )}{sin\ (\alpha + \ 90^0 - \ \theta)}$$

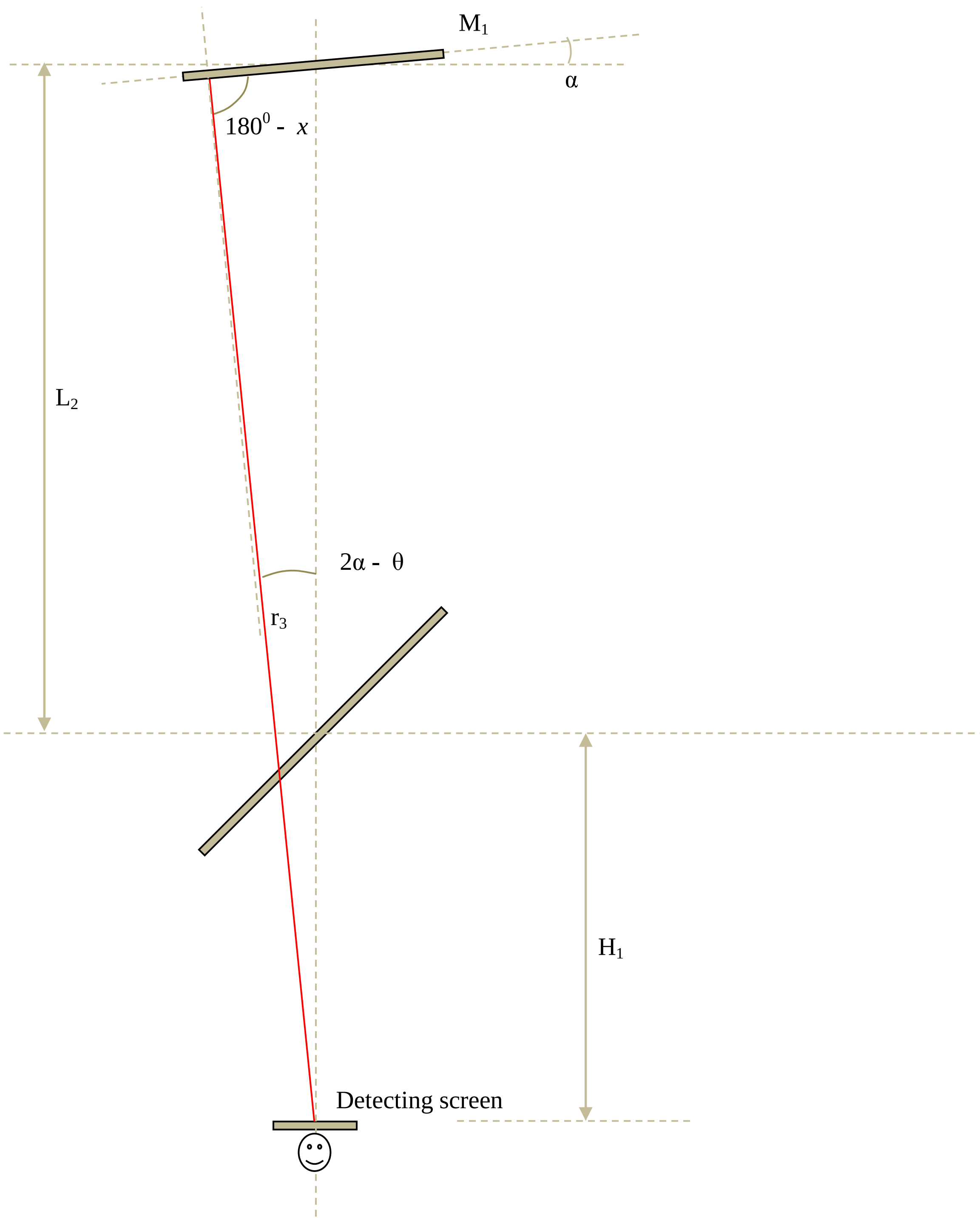
So far we have determined r_1 and r_2 as functions of θ.

To determine r_3 as a function of θ, consider the triangle formed by r_3 , mirror M_1 and the vertical line.

$$\frac{sin\ (90^0 - \alpha\ )}{r_3} = \frac{sin\ (180^0 - x\ )}{L_2 + \ H_1}$$

$$\Longrightarrow r_3 = \ \frac{(L_2 + \ H_1\ )\ sin\ (90^0 - \alpha\ )}{sin\ (180^0 - x\ )}$$

$$\Longrightarrow r_3 = \ \frac{(L_2 + \ H_1\ )\ sin\ (90^0 - \alpha\ )}{sin\ (90^0 + \theta - \alpha\ )}$$


M1
α
180⁰ - x
L2
2α - θ
r3
H1
Detecting screen

From the above diagram the angle between ray r_3 and the vertical is:

$$180^0 - (180^0 - x) - (90^0 - \alpha) = x + \alpha - 90^0 = (\alpha + 90^0) - \theta + \alpha - 90^0 = 2\alpha - \theta$$

Now, the horizontal component of r_1 MINUS the horizontal component of r_2 PLUS the horizontal component of r_3 equals H_2 .

$$r_1 \cos\theta - r_2 \sin\theta + r_3 \sin(2\alpha - \theta) = H_2$$

So far we have analyzed the light path of the red beam. The blue beam does not need any analysis (for absolute rest) because the beam reflects back on itself from mirror M_2. The path length of the blue beam is therefore exactly:

$$path\ length\ of\ blue\ beam = b_1 + b_2 + b_3 = (H_2 + L_1) + L_1 + H_1 = H_1 + H_2 + 2\,L_1$$

<u>Interferometer in absolute motion</u>

As before, we will just modify the equations derived above for the case of the apparatus at rest.

From the diagram below,

$$\frac{\sin 45^0}{r_1} = \frac{\sin(135^0 - \theta)}{H_2 + \Delta\, tan\, 45^0}$$

$$\Longrightarrow\ r_1 = \frac{(H_2 + \Delta \tan 45^0) \sin 45^0}{\sin(135^0 - \theta)} = \frac{(H_2 + \Delta) \sin 45^0}{\sin(135^0 - \theta)}$$

and

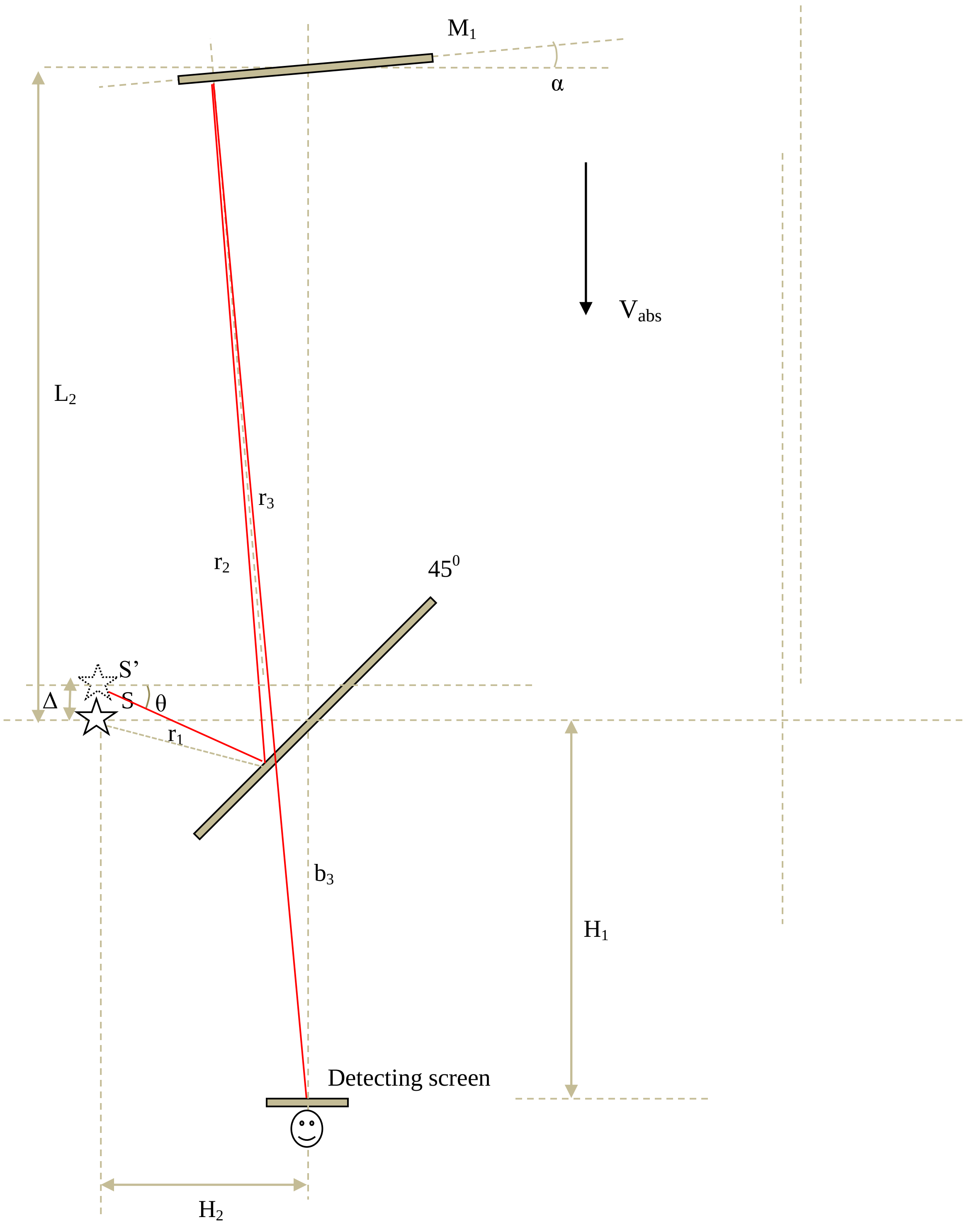
$$h = r_1 \sin\theta + L_2 - \Delta - (H_2 - r_1 \cos\theta)\, tan\, \alpha$$

$$r_2 = \frac{(r_1 \sin\theta + L_2 - \Delta - (H_2 - r_1 \cos\theta) tan\, \alpha)\, sin(90^0 - \alpha)}{sin\,(\alpha + 90^0 - \theta)}$$

$$r_3 = \frac{(L_2 + H_1)\, sin\,(90^0 - \alpha)}{sin\,(90^0 + \theta - \alpha)}$$

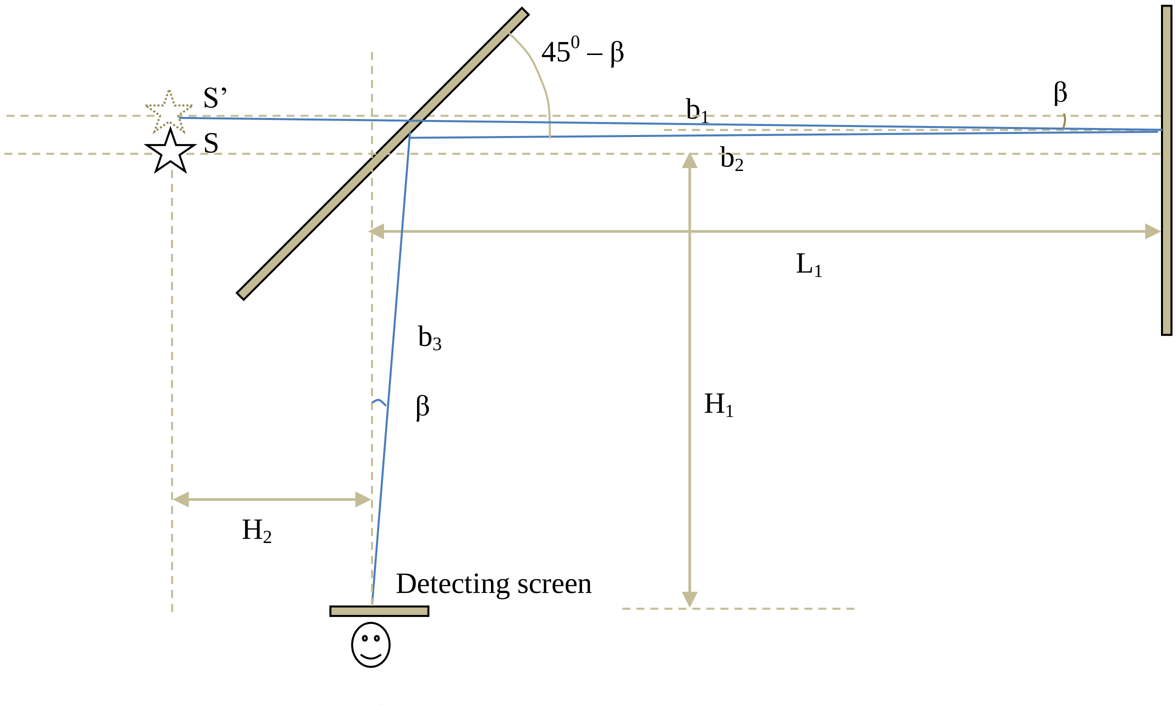
The horizontal component of r_1 MINUS the horizontal component of r_2 PLUS the horizontal component of r_3 equals H_2 .

$$r_1 \cos\theta - r_2 \sin\theta + r_3 \sin(2\alpha - \theta) = H_2$$



M1
α
Vabs
L2
r3
r2
45⁰
S'
S
Δ
θ
r1
b3
H1
Detecting screen
H2

The analysis of the blue beam is as follows.



Ray b_3 makes an angle of:

$$180^0 - (\,135^0 \;+\; 45^0 - \,\beta\,) \;=\; \beta$$

with the vertical.

Ray b_1 makes an angle β with the horizontal (below the horizontal).

Ray b_3 , the beam splitter and the vertical line form a triangle, from which:

$$\frac{sin\ 135^0}{b_3} = \frac{sin\ (45^0 - \beta)}{H_1}$$

$$\Longrightarrow\ b_3 \;=\; \frac{H_1\ sin\ 135^0}{sin\ (45^0 - \beta)}$$

But

$$\cos\beta \;=\; \frac{H_2 +\ L_1}{b_1}$$

$$\Longrightarrow \; b_1 \; = \frac{H_2 + \; L_1}{\cos\beta}$$

Also

$$\cos\beta \; = \; \frac{L_1 - \; b_3 \; \sin \; \beta}{b_2}$$

$$\Longrightarrow \; b_2 = \; \frac{L_1 - \; b_3 \; \sin \; \beta}{\cos\beta}$$

The sum of the vertical components of b_1 , b_2 and b_3 is equal to the sum of H_1 and Δ.

$$b_1 \; \sin\beta \; + \; b_2 \; \sin\beta \; + \; b_3 \; \cos\beta \; = H_1 \; + \Delta$$

Let,

$H_1 = H_2 = 0.2$m , $L_1 = L_2 = 1$m , $\alpha = 5^0$,

$\Delta = 0.3677$mm, corresponding to $V_{abs} =$ 390 km/s

Using excel I got a fringe shift of **53.4 fringes**.

Expected fringe shifts for different values of H1, H2, L1, L2, α are given in APPENDIX2.

Conventional Michelson-Morley experiments

By conventional MM experiments I mean MM experiments in which the beam splitter angle is exactly 45 degrees, and the mirror along the longitudinal path (M_2) is exactly vertical and the mirror along the transverse path (M_1) is exactly horizontal. In conventional MM experiments, the mirrors M_1 and M_2 are slightly tilted only to get straight fringes, not because the physicists understood the mystery that tilting the mirrors would increase the sensitivity of the apparatus. For them, basically, there is no significant difference between horizontal mirror M_2 and slightly tilted mirror M_2 and between vertical mirror M_1 and slightly tilted mirror M_1. For them, the only difference is that in the former we get circular fringes, whereas in the latter we get straight fringes.

In my previous paper[3], I presented an extensive analysis of an MM experiment in which the beam splitter is exactly at 45 degrees, mirror M_1 is exactly vertical and mirror M_2 is exactly horizontal. However, I have found simple errors[4] in that paper in two of the equations, wrongly leading to a prediction of fringe shifts. I have found that (by using Excel), after correcting those errors[4], the fringe shift is complete null. It should also be possible to show this analytically.

Discussion

The experimental implementation of the large fringe shifts calculated above requires that the angle between the red beam and the blue beam at the source be around 0.1 to 0.3 radians, which are large angles. Therefore, there are two requirements to the light source. The beam should be wide enough and the coherence length of the light should also be large. The first requirement can be met by ordinary light sources, and the second requirement by laser sources. So the largest fringe shift that can observed is practically limited, but much larger than fringe shifts obtained in conventional MM experiments such as the Miller experiments.

One may wonder why conventional MM experiments failed to reveal even a fraction of one fringe shift. As we have stated already, it is because the experimenters, unknowingly, initially set the interferometer to its least sensitive adjustment, such that the angle between the red (transverse) beam and blue (longitudinal) beam is very small at the source. They look for fringe shifts only after this initial adjustment. Also, even if they observed a large fringe shift at any point, for example by unknowingly setting the apparatus to its more sensitive adjustment, they would consider it as an experimental error and discard it. This is because the amount of fringe shift they expect is much smaller, based on ether theory. MM experiments were designed based on a wrong theory (ether theory) and thus failed.

At this point one may consider it confusing when I say the ether doesn't exist, and yet I propose modified MM experiments that are highly sensitive to absolute motion. In my papers [1-4] I have made it clear that the ether doesn't exist but absolute motion does exist. The question arises: if the ether doesn't exist, then what is absolute motion relative to? Apparent Source Theory (AST) is a new *model* that successfully explains many of the previously enigmatic and controversial light speed experiments. AST is concerned with the *effect* of absolute motion, not with what absolute motion *is* or with what light *is*. It should be noted that there has been no *model* that successfully explains the outcome of experiments for centuries, let alone a deep understanding of what light *is* and what absolute motion *is*. A correct model would lead to a deeper understanding. I claim that AST is such a model. I propose that absolute motion arises due to motion of an object (for example, an MM apparatus) relative to all matter in the universe. This is the conclusion one would reach considering the fact that the MM experiments gave "null" results, disproving the ether, but the Silvertooth experiment gave an apparent change in wavelength corresponding to 390 km/s, proving absolute motion.

Conclusion

The scientific community has ignored previous experiments that detected absolute motion, such as the Miller, the Silvertooth and the Marinov experiments. One of the reasons (although unjustifiable) is the fact that there has been no clear and consistent model to explain the effects observed in these experiments. Lack of a clear and consistent theory led to 'wrong' design and interpretation of experiments. I claim to have gained an insight that may have eluded physicists for centuries. My new theory has not only succeeded in explaining previously enigmatic and controversial experiments, but also provides a new insight to understand the 'flaws' in previous experiments and to design new experiments. The experiments proposed in this paper serve to test the new theory and prove the existence of absolute motion. A positive fringe shift in these experiments would possibly compel the scientific community to reconsider the foundations of relativity theory, to reconsider previously ignored experiments, to consider alternative theories and would lead to a complete understanding of the centuries old problem of motion and the speed of light.

Thanks to Almighty God Jesus Christ and His Mother Our Lady Saint Virgin Mary

Notes and references

1. *A New Theoretical Framework of Absolute and Relative Motion, the Speed of Light, Electromagnetism and Gravity*, by Henok Tadesse, www.vixra.com

2. *Co-existence of Absolute Motion and Constancy of the Speed of Light - Scientific Proof of God*, by Henok Tadesse, www.vixra.com

3. *New Interpretation and Analysis of Michelson-Morley Experiment, Sagnac Effect, and Stellar Aberration by Apparent Source Theory*, by Henok Tadesse, www.vixra.com

http://vixra.org/pdf/1808.0562v8.pdf

4. The mistakes in page of my previous paper [3] above are corrected as follows:

$$\left(\frac{S'T}{\sin(135^0 - \theta)} \sin\theta \sin 45^0 + (\,L2 - \Delta)) \right) \tan\theta \; + \; (L2 + H1\,) \tan\theta \; = \; \frac{S'T}{\sin(135^0 - \theta)} \cos\theta \sin 45^0 - H2$$

The red parenthesis was missing in the original equation.

And the equation:

$$RU = S'R \sin\theta + (L2 - \Delta)$$

should be replaced by the equation:

$$RU = \frac{S'R \sin\theta + (L2 - \Delta)}{\cos\theta}$$

I have solved the equations using Excel and found that, after making the above corrections, the fringe shift is complete null, i.e. for an MM experiment with the beam splitter exactly at 45 degrees, the mirror M_2 exactly horizontal and mirror M_1 exactly vertical.

Also on page 14 of the same paper [3] , the following correction is to be made:

The equation:

$$RU = (L2 + \Delta) - S'R \sin\theta$$

should be replaced by the equation:

$$RU = \frac{(L2 + \Delta) - S'R \sin\theta}{\cos\theta}$$

APPENDIX1

The expected fringe shifts for various dimensions of the MM interferometer (H_1 , H_2, L_1, L_2) and for various angles (α) of the beam splitter is shown below.

H_1	H_2	L_1	L_2	α	δ_1	δ_2	Angle between r_1 and b_1 at the source (for V_{abs} = 0 km/s)	Fringe shift
0.2m	0.2m	1m	1m	44^0	0.00377 nm	11791 nm	0.0349 radians	19.65 fringes
1m	1m	0.2m	0.2m	44^0	1.92 nm	38138 nm	0.03490653 radians	63.56 fringes
1m	1m	0.2m	0.2m	40^0	6.1285 nm	187620.4 nm	0.17453289 radians	312.69 fringes
1m	1m	0.2m	0.2m	30^0	38.708 nm	555254.5 nm	0.5235987 radians	925.36 fringes

APPENDIX2

The expected fringe shifts for various dimensions of the MM interferometer (H_1 , H_2, L_1, L_2) and for various angles (α) of mirror M_1 is shown below.

H_1	H_2	L_1	L_2	α	δ_1	δ_2	Angle between r_1 and b_1 at the source (for V_{abs} = 0 km/s)	Fringe shift
0.2m	0.2m	1m	1m	0.1^0	3655.41 nm	3013.68 nm	0.0017453 radians	1.07 fringes
1m	1m	0.2m	0.2m	0.1^0	3655.41 nm	446.788 nm	0.00174532 radians	5.3477 fringes
1m	1m	0.2m	0.2m	1^0	365531.6 nm	333445.96 nm	0.01745329 radians	53.476 fringes
0.2m	0.2m	1m	1m	5^0	9132724.58 nm	9100678 nm	0.08726644 radians	53.4 fringes
1m	1m	0.2m	0.2m	5^0	9132724.58 nm	8972490.8 nm	0.08726644 radians	267 fringes
0.2m	0.2m	1m	1m	20^0	144737710.1 nm	144611952.5 nm	0.34906582 radians	209.6 fringes
1m	1m	0.2m	0.2m	20^0	144737710.1 nm	144108280.4 nm	0.34906582 radians	1049 fringes