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The Direct Evidence ofthe Existence of Dark Matter andits Fluid Nature.If Dark Matter doesn't exist, the Universe will fall into Eternal Darkness

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Abstract:*The most general equations of the vertical rotating Michelson-Morley (VRMM)interferometer, have been derived to investigate its new predictions. The paper showsa very high sensitivity of the difference in arm lengths of the interferometer. Equal arm lengths makes the interference pattern oscillates in opposite directions during the cyclic rotation of the interferometer, while a slightincremental change in one of the arm lengths makes the interference patterneither moves in one direction or becomes stationary.The VRMM experiment proves, first,the direct evidence of the existence of dark matter, second,itsfluid nature and third,itsvertical flow onto Earth's surface(i.e. onto matter in general).The paper shows that, the interference pattern at the Perihelion location is different from that at the Aphelion, as well as the interference pattern at any Lunar Space Station at Perigee is different from that at Apogee. By eliminating the speed of the dark matter from the derived equations, the paper proves that, the universe will fall into an eternal darkness. Also, the paper shows that, the small scale (short arms) interferometers give better measurements, than the large scale (long arms) interferometers.*

Index Terms: *Optics;Michelson-Morley Experiment;Dark Matter; Interferometry; Interstellar*

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I. Introduction

In fact, the VRMM Interferometer hassupported the vertical flow of dark matter ontomatter [1], [2].However, the mainstream scientist don't want to accept these findings, due to the contradictions in the experimental results. The most common contradictionsappearing in the VRMM experiment are:

1. The oscillation of theinterference pattern (Martin Grusenick's experiment in Germany). [3]
2. The stationary interference pattern (Frank G. Pearce's experiment in USA). [4]
3. The moving interference pattern in one direction, no matter forward or backward (many experiments). [5]

Alternatively, maybe the mainstream do not accept the results of this experiment, as the acceptance means the radicalreview of the contemporary physics, which leads to the third age of paradigm shiftin physics.

So far, no formal theoryhas been presented for the VRMMinterferometer,capable to solvethe above riddles, or these three contradictory phenomena.For this reason, this paper has derived the very general equations for the vertical rotating interferometer, as shown in Fig.1, to cover the wide spectrum of all possible phenomena arising in these types of experiments. The analysespresented include the short, medium and the long arm types of Michelson-Morley interferometers. The study also includes the low speed and the high speed rotation of the interferometer. The paper introduces a new prediction concerning the difference between the lines of the interference pattern when Earth is at the Perihelion, and at the Aphelion, during its annual journey around the Sun, which is attributed to the existence of dark matter. Also, the paper shows that there is a differencein the interference pattern on the lunar space station at Perigee and Apogee.The objective of thispaper is to prove, first, the direct evidence of the existence of dark matter, second, its fluid nature and third, itsvertical flow onto matter [1], [2].

The paper is essential for understanding the nature of dark matter.Also, the paper shows that small scale (short arms) interferometers are better, in measurements, than the large scale (long arms) interferometers. Finally, the figures presented in this paper have been carefully selected from among hundreds of figures to achieve the purpose of this investigation.

II. Equations

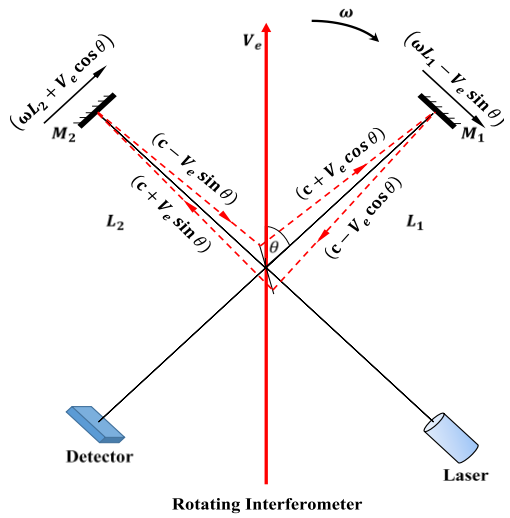


Fig. 1: shows a general position of theVRMM Interferometer inclinedby an angle $\theta$with the vertical flow of dark matter. For the sake of simplicity, the figure has been rotated 180°.

According to Fig. 1, the time,$\delta T1$,taken by the light during its to and fro journey to reach the semi-silvered mirror, will be given by;

$$\delta T1 = \frac{L_1}{\sqrt{(c+V_e\cos\theta)^2 - (\omega L_1 - V_e \sin\theta)^2}} + \frac{L1}{\sqrt{(c-V_e\cos\theta)^2 - (\omega L_1 - V_e \sin\theta)^2}} \quad (1)$$

And the time, $\delta T2$,taken by the light during its to and fro journey to reach the semi-silvered mirror, will be given by;

$$\delta T2 = \frac{L_2}{\sqrt{(c+V_e\sin\theta)^2 - (\omega L_2 + V_e \cos\theta)^2}} + \frac{L_2}{\sqrt{(c-V_e\sin\theta)^2 - (\omega L_2 + V_e \cos\theta)^2}} \quad (2)$$

Multiplying by c, to get the path difference, as follows;

$\Delta = c\delta T1 - c\delta T2$ (3)

And the number of fringe lines, N, will be given by;

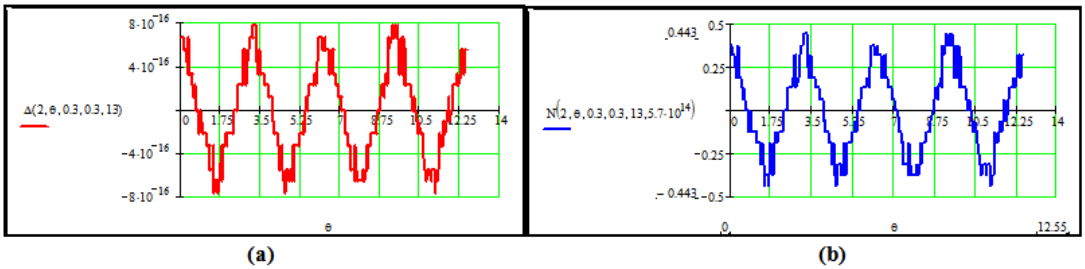
$N = \frac{\Delta}{\lambda} = \Delta \times \nu$ (4)

Both λ and $\nu$are the wave length and frequency of the laser beam of the interferometer.Equations (1 – 4) are the basic equations of the VRMM interferometer.

III. Results

First:Short-Arm-Length Rotating Interferometer(30cm),

Using equations (1-4), we shall investigate the performance characteristics of the short-arm interferometer for both the path difference, the number of fringes of thepattern, the different speeds of the angular rotation of the interferometer and the different speeds of the vertical flow of dark matter on Earth's surface.

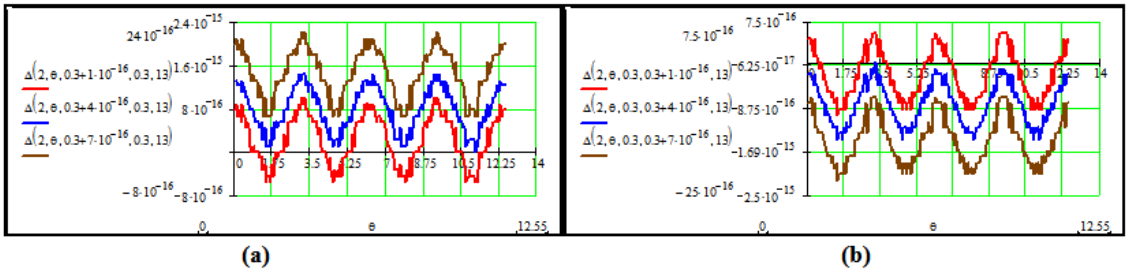


Figs. 2: (a) showsthe path difference Δ, and (b) shows the numberof the fringe lines$N$, against the angle of rotationθ, for two cycles of the rotating interferometer, with 2 revolutions per minute. The interference pattern oscillatesas in [3]. For the given model, the fringe shift is about four lines per one complete revolution.

To facilitate tracking the figures, it is necessary to explain the Mathcad legend adjacent to the left of the figures, for the path difference$\Delta;\Delta(rpm, \theta, L_1 , L_2 , V_e)$;where *rpm* stands for the revolution per minute of the interferometer, $\theta$is the angular position of the interferometer with the vertical flow of the dark matter, as shown in Fig. 1, L_1 , L_2 ,the lengths of the two arms of the interferometer andV_e The vertical velocity of dark matter.While for the number of the fringe pattern $N;N(rpm, \theta, L1 , L_2 , V_e, v)$,where the letters have the same meaning as above, and$v$stands for the frequency of the laser beam, all these parameters are drawn against the angular position$\theta$of the interferometer with the vertical direction of the dark matter flow, as shown in Fig. 1.

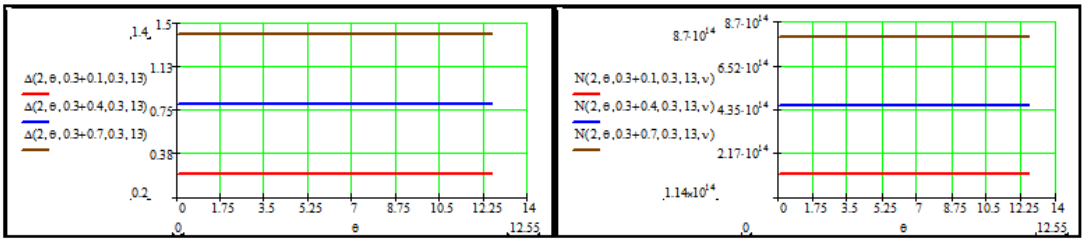
Figs. 2 show two cycles of the VRMM interferometer. Fig.(2-a) shows the path differenceΔthrough the two cycles. While, Fig.(2-b) shows the number of fringes Nthrough the two cycles.The shape is almost sinusoidally, which means that the pattern will oscillate with the rotation of the interferometer as in [3].

In Figs. 2, the speed of rotation of the interferometer is 2 rpm.The frequency of the light source, $\boldsymbol{\nu}$= 570 THz(5.7 × 10^{14} Hz) corresponding to a green light source.Both figures of the given model show that the pattern oscillates every 180^{o}. Fig. (2-b) shows that the number of fringe shift$\boldsymbol{N}$of the fringe lines is about four lines per complete cycle. The speed of dark matter is 13 m/s, which is calculated on the basis that; dark matter speed onto Earthis (0.8332 m/s), and that due to the Sun at Earth's location is (11.83 m/s) [2], where their sum isabout ~ 13 m/s. See table I.



Figs. 3: The effect of increasing one of the arm length of the interferometer.

Fig.(3-a) shows that the incremental increase in the length of the right arm, by an infinitesimal amount of order (1-7 × 10^{-16}) meters, pushes the whole interference pattern to lie in the first quadrant. While Fig.(3-b) show the increase in the left arm by the same amount pushes the pattern to lie in the fourth quadrant. This means that the motion will continue to move in the same direction to the right or to the left, without oscillation, but with different speeds, which is the case of many experiments [5]. In fact, the sensitivity to the incremental change in the arm length of the interferometer astonished the investigators, as a change in the arm length of order 10^{-15} meter can change the performance characteristics from oscillating pattern to move in one direction or even to stop the motion of the pattern completely. All the figures have been drawn against $\boldsymbol{\theta}$ and at 2 revolutions per minute.

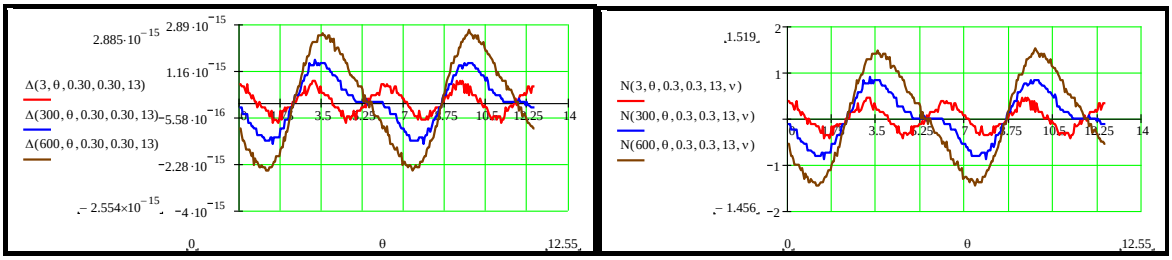


a- Constant path difference **b- Constant Fringe Lines *N***

Figs. 4: show the effect of increasing the length of the right arm by 1, 4 and 7 millimeters will stop the motion of the pattern [4]

Figs.(4) show the effect of the incremental increase of the length of the right arm of the interferometer, on the path difference $\boldsymbol{\Delta}$ and on the numberof lines of the interference pattern$N$, by an amount 1, 4 and 7 millimeters. These increments push the whole interference pattern to lie in the first quadrant. Both figuresshowthat Δ and N are constant, which means a stationary interference pattern; which is the case of [4].Clearly,Figs.(2), (3) and (4),solvethe three contradictory results previously mentioned.

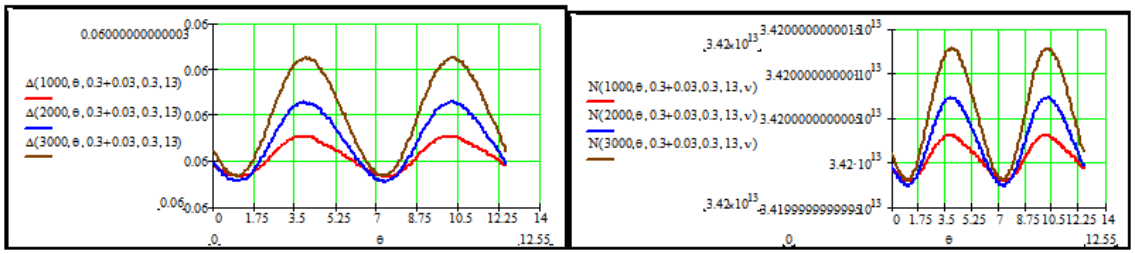
In the following we shall discuss the effect of increasing the rpm and the speed of dark matter on the interference pattern.



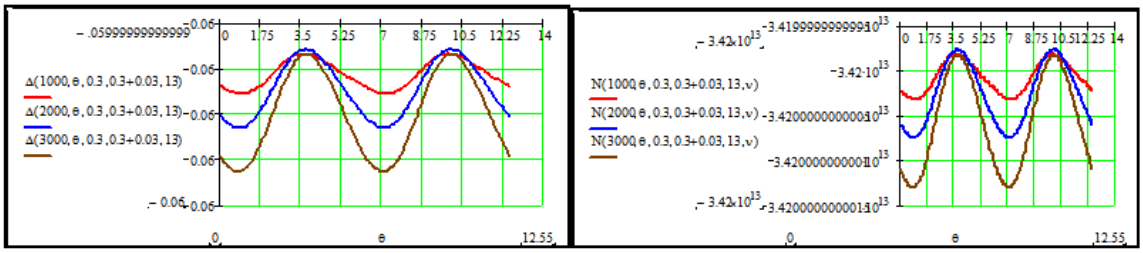
(a) **(b)**

Figs. 5: (a) and (b) show the effect of increasing the rpm (3, 300 and 600) on the interference pattern of the interferometer on Δ and N with two equal arms, each 30 cm length, respectively.

Figs.(5) show the effect of different revolutions per minute by an amount; 3, 300 and 600 rpm, on the path difference **Δ** and on the numberof lines of the interference pattern***N***.**The figures show a slowly increase in the number of the fringe lines as the rpm increases, however the pattern still oscillates to and fro with the rotation of the interferometer.



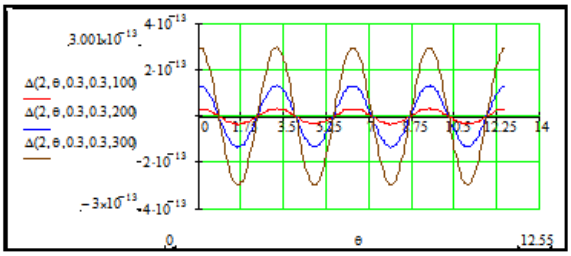
a- The first quadrant **b- The first quadrant**



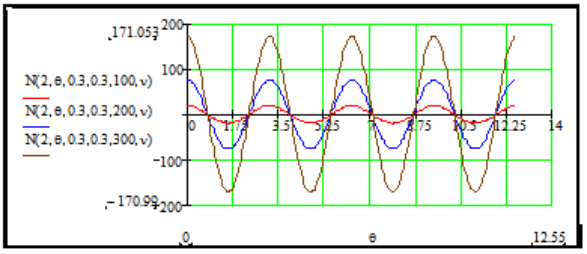
c- The fourth quadrant **d- The fourth quadrant**

Figs. 6: show the effect of increasing the rpm on the interference pattern of the interferometer with two different arm lengths.

Figs.(6-a) and (b) show a rotating interferometer with different speeds, 1000, 2000 and 3000 rpm, with the length of the right arm increased by (3 cm). This increase in length pushes the pattern to lie in the first quadrant, which means that the pattern will move in one direction. Practically speaking, according to the given calculations, a pattern composed of 3.5×10^{13} lines will apparently seems stationary. While Figs. (5-c) and (d) shows that the increase in length of the left arm by the same amount, $3cm$, will push the pattern to lie in the fourth quadrant, i.e. the pattern will move in the opposite direction or appears stationary. So differentlengths and high speedsof rotation of the interferometer can change completely the mode of the interference pattern.



(a) The path difference Δ

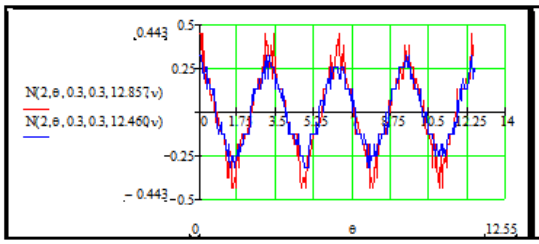


(b) The number of fringes N

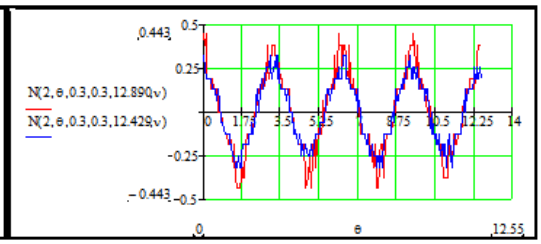
Figs. 7: show the effect of increasing the vertical speed of dark matter flow on the path difference Δ and the number offringe lines*N*, for an interferometer with equal arm lengths 0.3 m.

Figs. 7 show the increase of the speed of dark matter flow, causes a rapid increase in the number of fringe lines. Of course; there is no means to increase the speed of the dark matter flow. However, there is a chance to change the vertical speed ofdark matter flow on Earth and on Lunar Space Station, if we consider their annual rotation around the Sun.

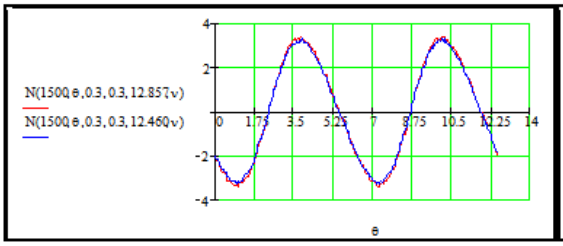
- **New Prediction**



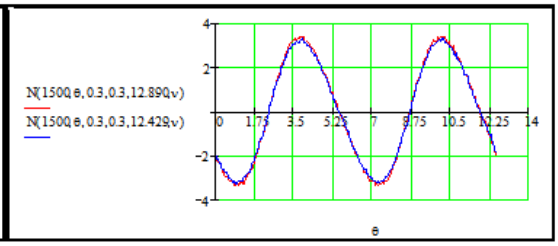
(a) The number of Lines N of the oscillating fringe pattern of an interferometer of 0.3 m arm length, and 2 rpm at Perihelion, and Aphelion.



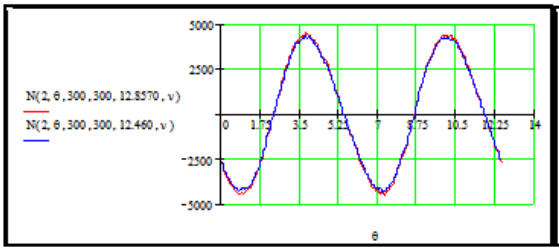
(b) The Number of Lines N of the oscillating fringe pattern as seen on an interferometer on the Lunar Space Station of 0.3 m arm length and 2 rpm at (Perihelion - Apogee),and at (Aphelion + Apogee).



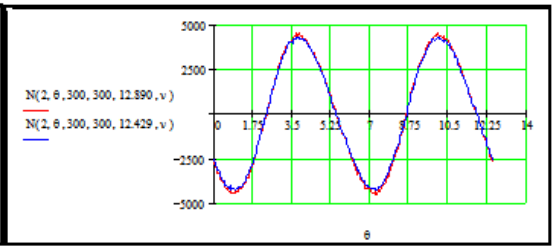
(c) The number of Lines N of the oscillating fringe pattern of an interferometer of 0.3 m arm length, and 1500 rpm at Perihelion, and Aphelion.



(d) The Number of Lines N of the oscillating fringe pattern as seen on an interferometer on the Lunar Space Station of 0.3 m arm length and 1500 rpm at (Perihelion - Apogee),and at (Aphelion + Apogee).



(e) The number of Lines N of the oscillating fringe pattern of an interferometer of 300 m arm length and 2 rpm at Perihelion, and Aphelion.



(f) The Number of Lines N of the oscillating fringe pattern as seen on an interferometer on the Lunar Space Station of 300 m arm length and 2 rpm at (Perihelion - Apogee),and at (Aphelion + Apogee).

Figs. 8: show the number of lines of the interference pattern *N* on Earth's surface at Aphelion and at Perihelion,and on a lunar space station at (Perihelion - Apogee) and at (Aphelion + Apogee). Note when subtracting the location of Perihelion from Apogee we get the shortest distance between the sun and the lunar space station.

Making use of table I, Figs. 8 show thesummary of the considerable trials made, to get the optimum design ofan interferometer that gives theclear difference of the interference patterns between the two Earth's locations at **Perihelion** and **Aphelion** (fig. 8-a), as well as at the two lunar space locations at **(Perihelion - Apogee) and (Aphelion + Apogee)** (fig. 8-b) of ESA'sspace station.

Figs. (8-c,d) and (8-e,f) show that the increase inspeed of rotation,and arm lengths of the interferometer respectively will make the two patterns approaches each other and ultimately coincide on each other, and becomes toodifficult to distinguish between them. It is found that, in case of small scale interferometers (with short arms) with low rpm, of course with high accuracy, are much betterin distinguishing between the two patterns, than the large scale interferometers (with long arms) with high rpm.

As shown in Fig. (8-a) there is a difference between the maximum value of ***N*** at **Perihelion**and the maximum value of ***N*** at **Aphelion**, which can be detectedand recorded by the interferometer. Similarly, as shown in Fig. (8-b) there is a difference between the maximum value of ***N*** at **(Perihelion - Apogee)**and the maximum value of ***N*** at **(Aphelion + Apogee)**, which can be detected and recorded to be compared, to prove the existence of the dark matter as well as its fluid nature.

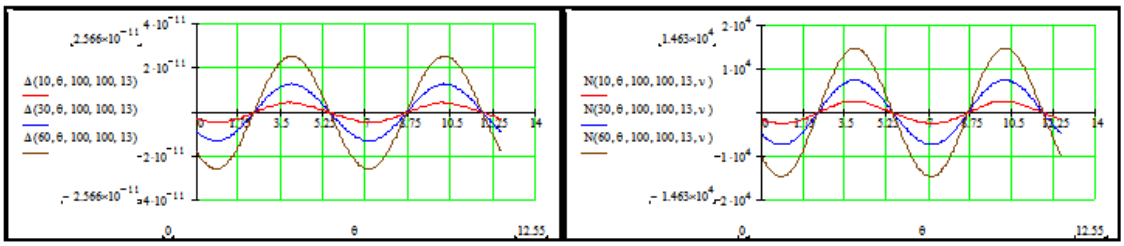
The comparison between Figs. (8-a), (8-b) with Figs. (8-c), (8-d), shows increasing the speed of rotation, increases the number *N* of the interference pattern. While Figs. (8-e), (8-f) show the increase of the arm lengths excessively increases the number,***N,*** of the interference patter. However, in all these cases the patterns at the different locations almost coincide on each other and becomes toodifficult to be distinguished, and need sophisticated high accurate interferometers.It is worth mentioning that, theincrease of frequency of the light source will slightly increase the number of lines of the fringe pattern, and so it is not included in Figs.(8).

Finally, the conclusion is that; the difference between the speeds of dark matter at different locations confirmed by the difference between the two interference patterns shown in Figs.(8-a) and (8-b), confirm the fluid nature of dark matter.However, it needs high precision interferometers to detect exactly the difference between the two patterns. Of course, the main objective of thisrecommended experiment is to confirm, **first,** the direct evidence of the existence of dark matter, **second,**its fluid nature and **third,** its vertical flow onto Earth's surface, i.e. onto matter in general.

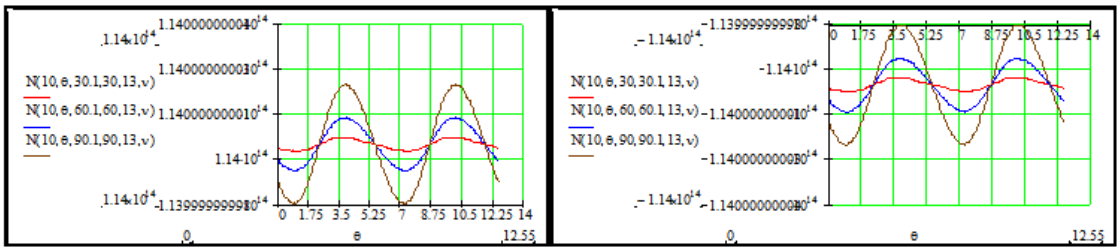
Second: Medium-Arm-Length Rotating Interferometer (10 - 100 meters)

The medium and the long length interferometers can be obtained by using multiple reflection mirrors system to attain the required size from any moderate size interferometers.

In order to avoid repetition, it is sufficient to display the key excerpts from the full investigation of interferometers with medium arm lengths to illustrate the basic concept.Figs.(10) and (11) show the key excerpts with sufficient interpretive captions.



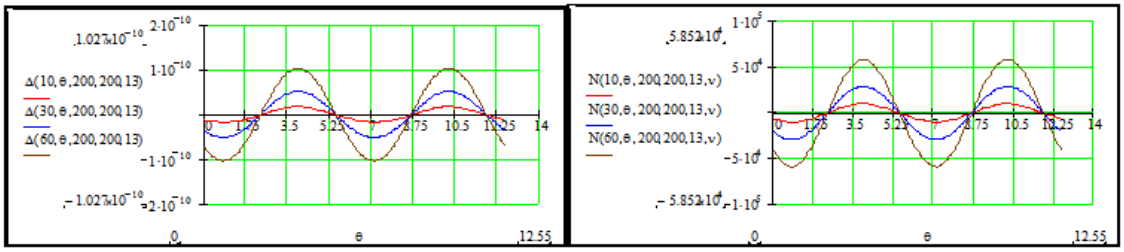
Figs. 9: show the path difference Δ and the corresponding number*N* of lines of the interference pattern, for a medium-arm-length interferometer, of equal arm lengths 100 m each. The figures show oscillating patterns at different revolutions per minute; 10, 30 and 60 rpm. The number *N* of the interference pattern increases with the increase of the angular rotational speed.



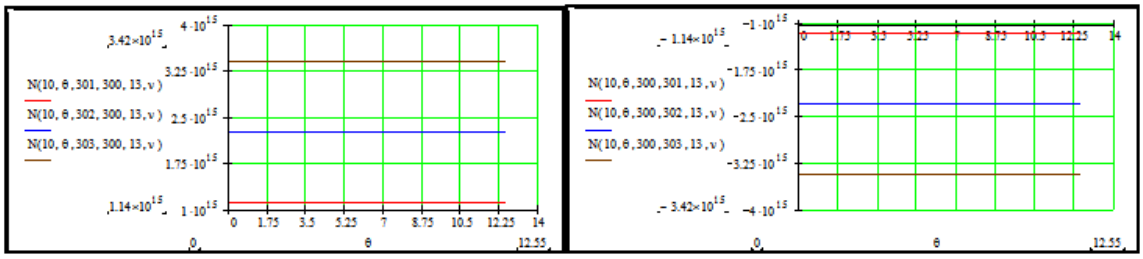
Figs. 10: show the number of lines of the interference pattern,*N*, for two medium arm length interferometers.The left figure shows the length of the right arm of the interferometer has increased by 1 cm than that of the right arm. While the right figure shows the left arm has been increased by 1 cm than thatof the right arm of the interferometer. Both cases pushes the pattern to lie in the first and the fourth quadrants respectively, which mean that the motion of the pattern will move in one direction,either forward or backward. As we note, the number *N*of lines is extremely large which mean that the pattern will appear stationary. The figures has been drawn for 10 rpm.

Third: Long-Arm-Length Rotating Interferometer (greater than 100 meters)

In the same way to avoid repetition, it is sufficient to display the key excerpts from the full investigation of interferometers with long arm lengths to illustrate the concept.



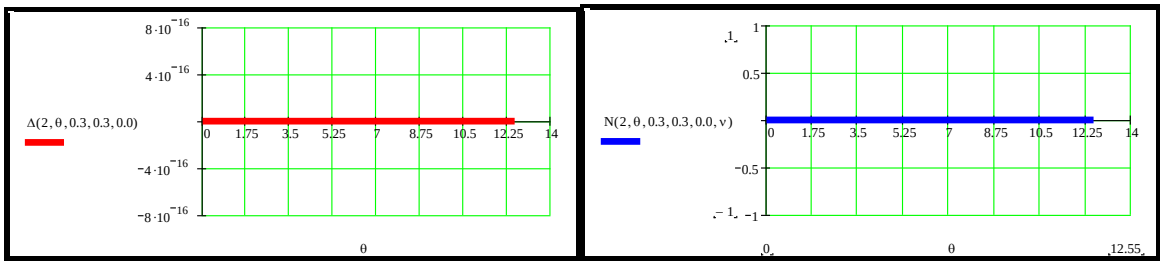
Figs. 11: show the path difference Δ and the corresponding number *N* of lines of the interference pattern, for a long arm interferometer, eachof 200 m length. The figures show an oscillating pattern and aredrawn for different revolutions per minute 10, 30 and 60 rpm. The more rpm the more the number N of the interference pattern.



Figs. 12: show the number of lines *N*of the interference pattern, for different long-arm interferometers of 300 m length. The left figure shows 3 different interferometers where the length of the right arm has increased by 1, 2 and 3 meters than that of the left arm. While the right figure shows the 3 different interferometers where the left arms have increased by 1, 2 and 3 meters than that of the right arms of the interferometers. Both cases push the patterns to lie in the first and in the fourth quadrants, and becomes stationary. The figures are drawn against $\boldsymbol{\theta}$ and for 10 rpm.

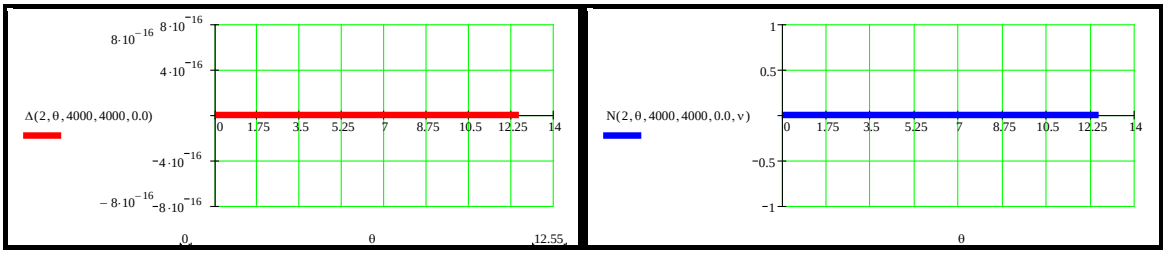
Does dark matter really exist and hasa fluidnature?!

In all the previousinvestigations, we have assumed that dark matterexists and has a certainvertical speed onto Earth's surface, as shown in figure 1.Now if dark matter does not exist,what can we expect? This case can be achieved by putting the speedof the dark matter equals zero in the above equations. The question arises, would we get in this case, the same interference patterns in one way or another?!



(a) Zero path difference Δ of 30 cm arm length interferometer

(b)Zero number of fringe pattern *N* of 30 cm arm length interferometer



(c)Zero path difference Δ of 4 km arm length interferometer

(d)Zero number of fringe pattern *N* of 4 km arm length interferometer

Figs. 13:(a) and (b) show the zero path difference Δ and the zeronumber of fringe lines*N* of the interference pattern, of 30 cm arm length interferometer. While Figs. (c) and (d) show the same zero path difference Δ and the same zero number of fringe lines *N* of the interference pattern, of 4 km-arm length interferometer.

Figs. 13 answer this question. In fact, if dark matter does not exist, we will get nothing! No interference pattern, no oscillating pattern, no stationary pattern and no moving pattern. All we get is zero pattern, as shown in Figs. 13. Also the direct meaning of Figs. 13 is that, if dark matter does not exist, the whole universe will fall into the eternal darkness.**Hence the necessary and sufficient condition for the existence of dark matter, is the existence of the interference pattern. Therefore, the Vertical Rotating Michelson-Morley experiment is the direct evidence of the existence of dark matter and its fluid nature.**

IV. Conclusion

The paper fully investigates almost all aspects of the theory of the vertical rotating Michelson-Morley Interferometer. The most general equations of the rotating interferometer, have been derived, to cover all the possible design considerations of these types of experiments. All contradictions that have been emerged in the laboratory experiments have been explained and solvedon the basis ofthe derived equations. The paper shows a very high sensitivity to the difference between the lengths of the two arms of the interferometer. Equal arm lengths makes the interference pattern oscillates in opposite directions during complete cyclic rotation of the interferometer, while a slight incremental change in the length of one of the arms make the patterneither moves in one direction or becomes stationary.The paper investigates the different cases of the effect of varying;the arm lengths,the angular rotationalspeed, as well as the different speeds of the vertical flow of dark matter, on the interference patternof the interferometer.

The paper introduces a new prediction, as it shows that, the interference pattern at Earth's Perihelion in its journey around the Sun, is different from that at the Aphelion.Also, it shows that the interference pattern of an interferometer on the Lunar space station at Perigee will be different from that at Apogee. Both experiments confirm, first,the direct evidence of the existence of dark matter, second,the fluid nature of dark matter, and third, the vertical flow of dark matter flows onto matter.Also, the paper proves that, if dark matter does not exist, the universe will fall into eternal darkness. Also, the paper shows that, small scale interferometers are better in measurements than large scale interferometers.

Table I: Distances and speeds of dark matter at different locations of Earth and lunar space station [2]

Max. & Min. locations from the Sun	Distance from Sun (meters)	Dark matter speed onto the Sun at the corresponding locations (m/s)	Dark matter speed onto Earth alone (m/s)	Total speed of dark matter (m/s)
Perihelion	1.4717×10^{11}	12.024	0.833**	12.857
Aphelion	1.5219×10^{11}	11.627		12.460
Perihelion – Apogee*	1.468×10^{11}	12.057		12.890
Aphelion + Apogee*	1.526×10^{11}	11.596		12.429

* The distances of the Moon from Earth at Perigee and Apogee are given respectively by;
(3.56375×10^8 m) and (4.0672×10^8 m). The calculations arecarried out based on the two positions of Perihelion and Aphelion and Apogee are aligned with the Sun in each case.

** The estimated velocity of dark matter at the solar system due to the black hole at the center of our Milky Way Galaxy is about 0.029 m/s, which is neglected in our calculations.

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