The Michelson-Morley experiment and the gravity

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Abstract

The Michelson-Morley experiment was designed to detect the Earth's motion relative to the "aether". The experiment yielded a null result a fundamental proof that a speed of light is invariant. This ultimately paved the way for Einstein's theory of special relativity. Our assumption is that Earth's own gravity creates a preferred frame [1], which rotates around Earth's axis in relation to an infinitely distant fixed point. This directly affects the result of MM experiment. In order to test this hypothesis, it is necessary to perform MM in an environment where gravity is approximately equal to zero.

Keywords: *The Michelson-Morley experiment, Speed of light*

1. Introduction

It is obvious that it is practically impossible to reach a space where the gravity would be equal to zero, so we will assume that it is enough to perform the experiment in a space where the gravity is significantly smaller compared to gravity on Earth. Our suggestion is that the experiment could be carried out within one of the existing lunar missions.

2. Determining the point of "null gravitation"

We will assume that the Earth, the rocket, the Moon and the Sun lie on the same line Fig(1). This happens twice a month during every new moon and full moon.

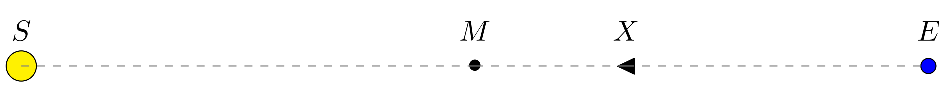

Figure 1: the Earth, the rocket, the Moon and the Sun lie on the same line

$$\begin{aligned}
M_S &= (The\, mass\, of\, the\, Sun)\\
M_E &= (The\, mass\, of\, the\, Earth)\\
M_M &= (The\, mass\, of\, the\, Moon)\\
R &= (The\, average\, distance\, between\, the\;\, Earth\, and\, the\, Sun)\\
r &= (The\, average\, distance\, between\, the\;\, Earth\, and\, the\, Moon)\\
x &= (The\, distance\, between\, the\;\, Earth\, and\, the\, rocket)
\end{aligned}$$

Now we will determine the gravity of the Sun, the Moon and the Earth in relation to the rocket, whose position is marked by point X, Fig(1).

$$x = EX \tag{1}$$

$$g_S = \frac{G\,M_S}{(R-x)^2} \approx \frac{G\,M_S}{R^2} \tag{2}$$

$$g_M = \frac{G\,M_M}{(r-x)^2} \tag{3}$$

$$g_E = \frac{G\,M_E}{x^2} \tag{4}$$

$$\tag{5}$$

After that we will find a point between the Earth and the Moon so that the sum of the gravities g_S, g_M and g_E is minimal in relation to the rocket.

$$\Delta g = g_E - g_S - g_M \tag{6}$$

$$\Delta g = 0 \tag{7}$$

$$\frac{M_S}{R^2} + \frac{M_M}{(r-x)^2} - \frac{M_E}{x^2} = 0 \tag{8}$$

$$M_S\,(r-x)^2\,x^2 + R^2\,M_M\,x^2 - R^2\,M_E\,(r-x)^2 = 0 \tag{9}$$

$$M_S\,(r^2\,x^2 - 2\,r\,x^3 + x^4) + R^2\,M_M\,x^2 - R^2\,M_E\,(r^2 - 2\,r\,x + x^2) = 0 \tag{10}$$

$$M_S\,x^4 - 2\,M_S\,r\,x^3 + (M_S\,r^2 + R^2\,M_M - R^2\,M_E)\,x^2 + 2\,R^2\,M_E\,r\,x - R^2\,M_E\,r^2 = 0 \tag{11}$$

Thus, we obtained an equation of the fourth degree,

$$x^4 + b\,x^3 + c\,x^2 + d\,x + e = 0 \tag{12}$$

where

$$b = -2\,r \tag{13}$$

$$c = r^2 + R^2\,\frac{M_M}{M_S} - R^2\,\frac{M_E}{M_S} \tag{14}$$

$$d = 2\,R^2\,\frac{M_E}{M_S}\,r \tag{15}$$

$$e = -R^2\,\frac{M_E}{M_S}\,r^2 \tag{16}$$

We will test the solutions of equation (12) on the following example.

$$G = 6.6743\,E - 11$$
$$M_S = 1.989\,E30$$
$$M_E = 5.972\,E24$$
$$M_M = 7.34767309\,E22$$
$$R = ES = 1.5\,E11$$
$$r = EM = 3,844\,E8$$

All numbers are expressed in the International System of Units (SI).

$$b = -7.68000E + 08 \tag{17}$$
$$c = 8.07306E + 16 \tag{18}$$
$$d = 5.18834E + 25 \tag{19}$$
$$e = -9.96162E + 33 \tag{20}$$

Equation (12) has only one solution ($x = 253609087[m]$), for which the condition ($0 < x < r$) is satisfied.

$$\Delta g = g_E - g_S - g_M \tag{21}$$
$$\Delta g = 6.19693E - 03 + (-5.91982E - 03) + (-2.88431E - 04) \approx (-1.13203E - 05) \left[\frac{m}{sec^2}\right] \tag{22}$$

If ($x = 253397190[m]$) then

$$\Delta g = (6.20730E - 03) + (-5.91980E - 03) + (-2.87495E - 04) \approx (-4.60489E - 12) \left[\frac{m}{sec^2}\right] \tag{23}$$

The gravities of the other planets and the Galaxy were not taken into account.

3. Conclusion

If the result of the experiment were negative, it would be a great practical contribution to the correctness of the *Theory of Relativity*. Otherwise, it would mean that postulate about the constancy of the speed in a vacuum does not hold. In that case, since the gravity in the rocket changes on the way to the Moon, we would be able to determine how gravity affects the result of the experiment. Naturally, the question arises as to how gravity affects other not only physical but also chemical, biochemical ... processes.

4. Conflicts of Interest Statement

The author has no conflicts of interest to disclose.

References

[1] Čojanović M.
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