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The Wang anomaly during a total Solar eclipse: an electromagnetic analysis

Thierry De Mees

e-mail: thierrydemees@telenet.be

The gravity measurement of Qian-shen Wang during the total eclipse of the Sun on 9 March 1997 showed a strange diagram-shape over time. In this paper, I investigate this shape by setting up a simple scenario: the double shielding of the used gravimeter didn't totally exclude an induction of the fast electrons of the Sun's corona. The passage of the Moon shielded the fields. Neither the hypothesis of a gravitational shielding, nor a temperature effect can be maintained.

Keywords: Gravity waves, solar eclipse, gravitational shielding.

1. Introduction

Qian-shen Wang *et al.* has measured the gravity during a solar eclipse [1,2] by using a very high-accurate LaCoste-Romberg D gravimeter [4]. The precision of this gravity meter is 2 to 3 × 10^{-8} m/s^2 or 2 to 3 µgal.

This device works as follows (figure 1):

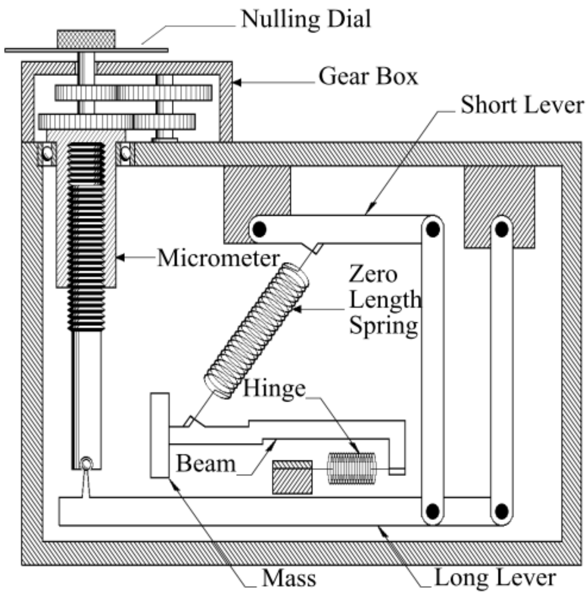

Figure 1. *LaCoste-Romberg D gravimeter working principle.*
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The manual explains: "The simplified diagram of the meter shows a mass at one end of a horizontal beam. At the other end of the beam are a pair of fine wires and springs that act as a frictionless hinge for the beam. The beam is supported from a point just behind the mass by a "zero length" spring. The spring is at an angle of approximately 45 degrees from horizontal. The meter is read by nulling the mass position, that is, adding or subtracting a small amount of force to the mass to restore it to the same "reading" position.

Few ferrous metal parts are used in the meter. The meter is demagnetized or compensated, then installed in a double µ-metal shielding to isolate it from magnetic fields. Changes in air pressure could cause a small apparent change in gravity because of the buoyancy of the mass and beam. This is prevented by sealing the interior of the meter from the outside air. As an additional precaution, should the seals fail, there is a buoyancy compensator on the beam."

The set-up of the measurement is explained by Wang et al.: "in order to ensure the accuracy of the measurement, the gravimeter was installed well earlier before the eclipse. The gravimeter reading was tested for several times to simulate real time recording. The real-time recording began at 15:00 in the afternoon on 5 March 1997, and go on continuously until 15:00 on 12 March 1997.

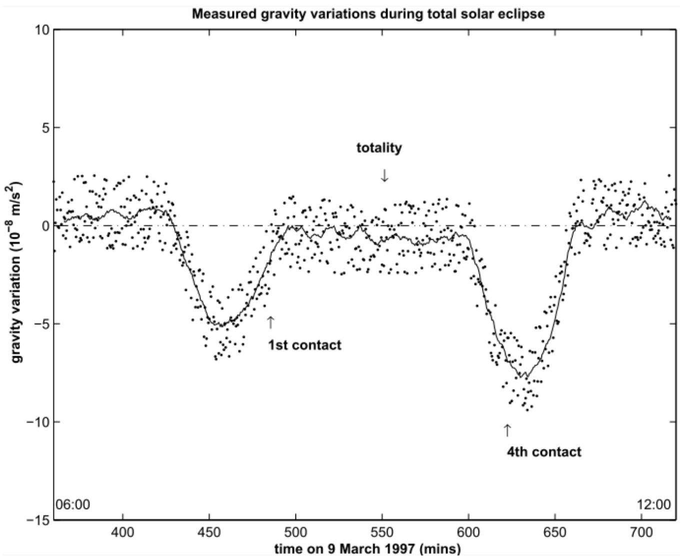

Figure 2. *Measurements of the total eclipse of the Sun on 9 March 1997. The solid curve is the averaged variation over a moving 10-minute window.*

The sampling reading interval is 1 minutes. The sampling was increased near the eclipse. The data reading was recorded at a rate of 2 reading every minute from 06:00 am to 12:30 pm and at a higher sampling rate of 1 reading per second during the eclipse from 08:00am to 10:30am."

The parameters of the total eclipse are: sunrise at 06:20:00 (local time), first contact at 08:03:29, second contact at 09:08:18, third contact at 09:11:04, and fourth contact at 10:19:50.

The result of the total eclipse of the Sun on 9 March 1997 is given in the figure 2.

2. Reading of the data

In the figure 3, I have drawn the graph's median in time, which shows a shift compared to the points of contact between the Sun and the Moon. In terms of time, I estimate it to about 8 minutes, for both the Moon and the Sun. When I apply that time correction, the two lows of the graph become symmetrical to the corrected 1st contact and 4th contact. The small arrows are the original positions, the vertical lines are the corrected positions.

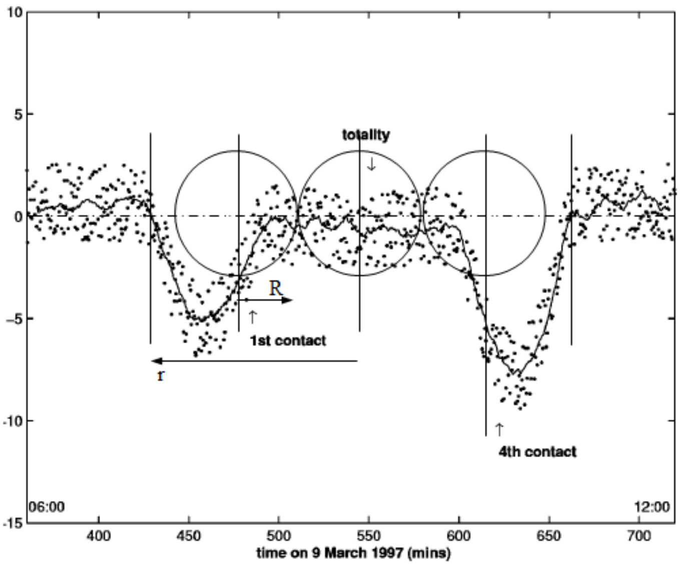

Figure 2. *A better reading of the measurements of the total eclipse of the Sun on 9 March 1997. A symmetrical corrected position of the Sun is shown, with a shift of the 1st and 4th contacts about 8 minutes ahead in time. The Moon is shown at its corrected first contact. The apparent radius of the Sun and the Moon is* R*, the position of the anomaly's edge is* r*. Between the first and the 4th contact, we have a distance of nearly* 4 R.

Remark that the small arrow of total eclipse doesn't exactly fit with the half the time difference between the 1st and the 4th contact, because the duration of the total eclipse lasted for a few minutes.

When the apparent radius of the Sun and the Moon is *R*, the estimated first low is at about *R* from the position *r* of the anomaly. Between the first and the 4th contact, we have a distance of 4 *R*. The center of the Moon will then have travelled over 4 *R*.

In the first place, even before trying to find an explanation to the phenomenon, it is important to read what happens. When the Moon touches the position *r*, there is a decrease of the measured gravity, which happens far before the first contact. The second low is more important than the first one, but the width of both gravity depressions is about identical and equals to *R*. The lows of the gravity depressions are symmetrical to a fictive position of the Sun.

3. Detailed positional analysis suggests an almost instantaneous action of the detected anomaly

Before setting up some scenario, remark that the graph becomes more symmetric when it the Sun shifted 8 minutes ahead in time, which suggests that the effect occurred almost instantaneously if it started from the Sun.

The start of the first depression is shown in figure 4.

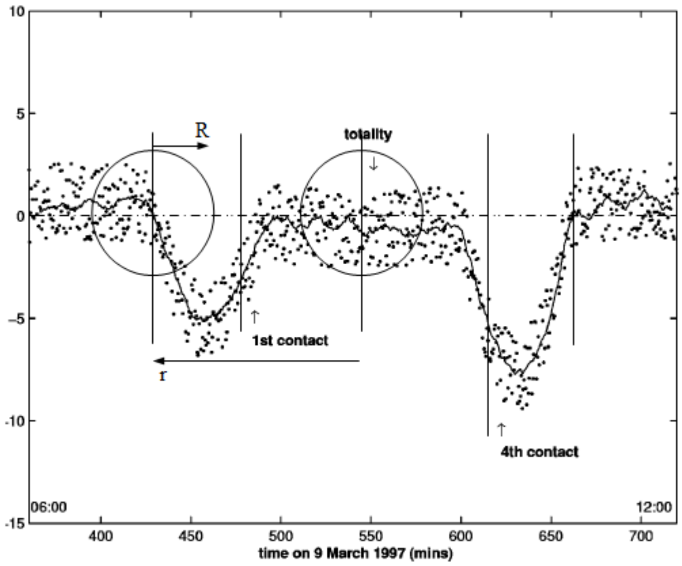

Figure 4. *Position of the Moon when the first depression starts (corrected positions).*

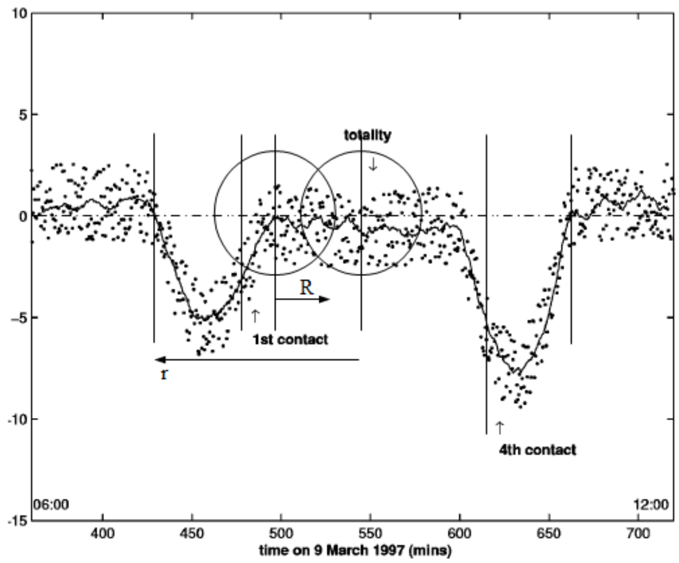

Figure 5. *Position of the Moon when the first depression ends (corrected position).*

The figure 5 shows the position of the moon when the first depression ends.

We have here a position where the Moon has just crossed the first half of the Sun. The depressions are strong at both sides of the Sun, but especially outside the Sun's boundaries.

4. Is the Moon's core shielding something?

But when we look closer to the Moon's composition, it appears that the core is iron-rich and solid. Could the Moon's core be the cause of a shielding?

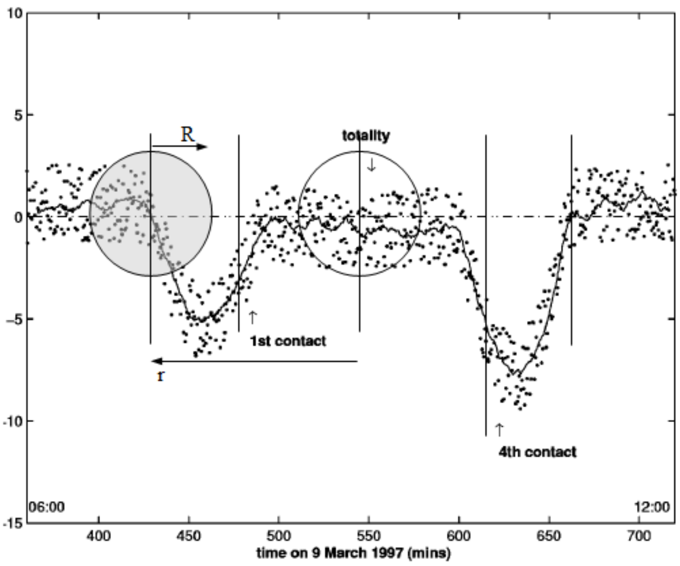

Figure 6. *Position of the Moon when the first depression starts. The Moon's core is still far away from the Sun's edge (corrected position).*

The figure 6 shows the position of the Moon when the measured depression begins. The presumed iron core of the Moon is still far away from the Sun's edge.

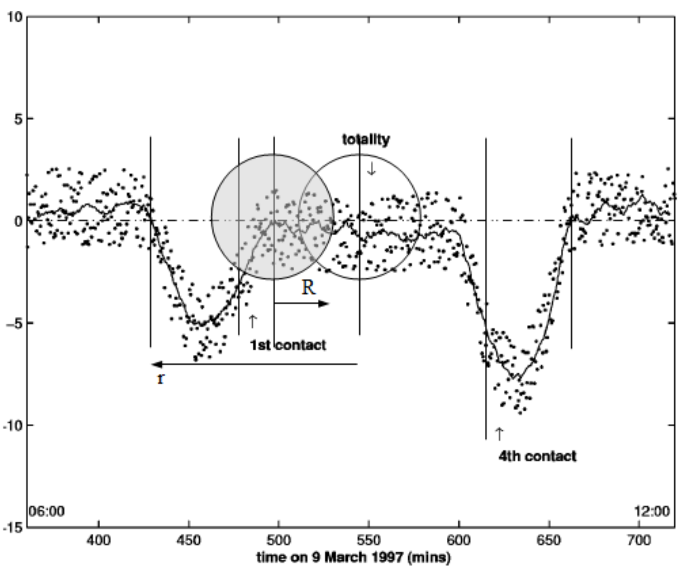

Figure 7. *Position of the Moon when the first depression ends. The Moon's core is on the Sun's edge (corrected position).*

The figure 7 shows the Moon's position when the measured depression ends. The core is on the Sun's edge.

The first measured depression occurs between the lunar positions of figures 6 and 7, the place where the Sun's corona is situated.

Let us redraw the figures 6 and 7 but with the corona emitter between-in the two positions of the Moon's core. The figures are 8, 10. I also drew the intermediate position in figure 9, where the Moon's core is shielding the corona emitter.

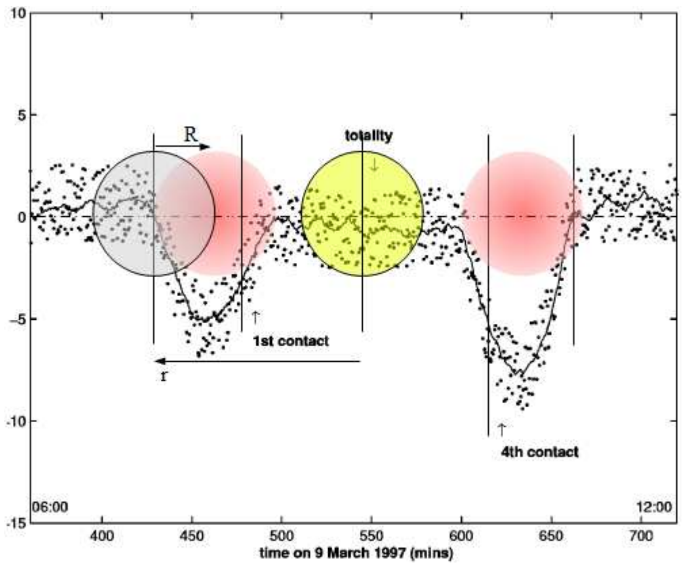

Figure 8. *Position of the Moon when the first depression starts. The Moon's core is at the left edge of the corona emitter near the Sun's edge (corrected position).*

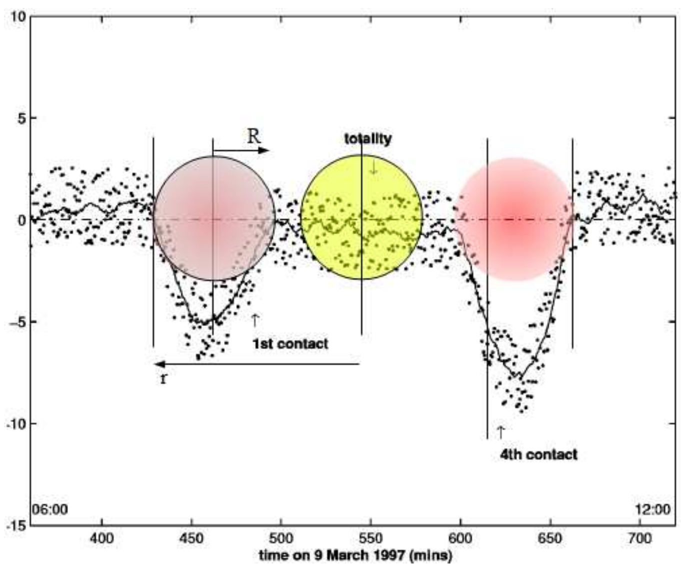

Figure 9. *Position of the Moon at shielding of the extra-corona emitter (corrected position).*

It is remarkable that in the case of this setup, the data fit well for the shielding positions. Remark that the corona is a shell about the Sun, and that the drawn corona spot is the part that comes into account for the shielding effect.

I limited the size of the presumed Moon's core, about a fifth of its diameter. But is there any physics that could justify such a setup anyway?

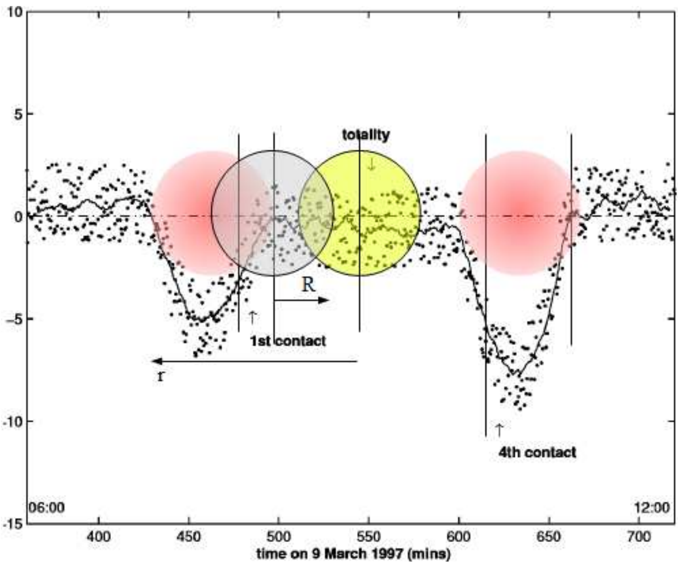

Figure 10. *Position of the Moon when the first depression ends. The Moon's core is at the right edge of the corona emitter near the Sun's edge (corrected position).*

5. Unsuccessful explanations

Chris P. Duif [3] made an analysis of conventional explanations in 2004 and some of the explanations have been made suspicious or eliminated by him already, based upon several measurements in the past, during an eclipse, by using a short Allais pendulum. Such a pendulum is released in a certain direction, generally every 20 minutes in time, and the tilt alterations are measured. The mathematical and physical interpretations of the short pendulum are not always very clear, and even Maurice Allais lost himself in a wrong interpretation of the data during his long research, by reporting to the NASA that he had found a new gravity effect [6], whereas in reality the combination of the Earth's Coriolis effect and the effect of the Earth's tilt, which altered the pendulum tilt, remained unnoticed by him.

But for the present Wang eclipse, the relationship between the phenomenon and the measurements is very direct, and it is obvious that no gravitational effect can be at the origin of the depressions. The corona's mass is definitely very low, and the passage of the Sun's diameter by the Moon's core should in that case shield a much stronger gravitational field, which it obviously doesn't do.

Also the effect of temperature variations in the atmosphere can be excluded here. The measured depressions are far too precisely related to the Sun's apparent edges, formed by the corona, and a temperature drop should strongly alter the measurements as long as the Sun is visually shielded by the Moon.

It is clear that none of the explanations of the Duif review is suitable for the explanation of the present eclipse measurements. A better analysis of the Solar corona can possibly put a clear light on the issue.

6. Solar magnetic boundary conditions

A shell around the Sun's equator could be responsible for the emission of a kind of wave that can be shielded by iron but detected by the gravimeter. Since the gravimeter is not sensitive to magnetism according to the builders, the detected wave should be gravitational. But on the other hand, the wave is shielded by the Moon core and the lower mantle, in this case, by iron that can be partly liquefied. Is it just the core's mass that shielded the wave, or the specificity of the iron?

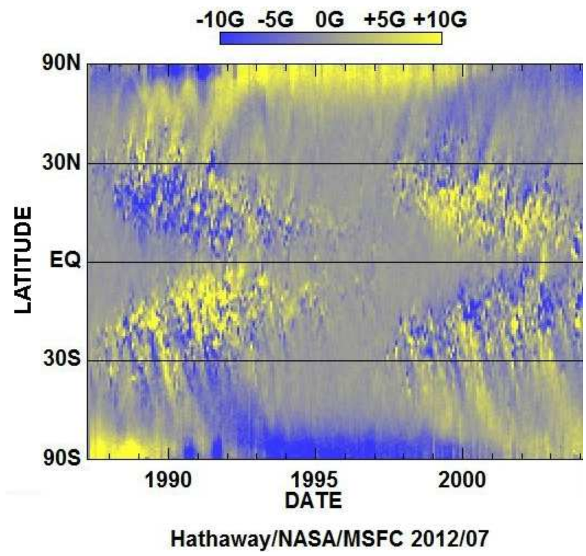

Figure 11. *The Sun's magnetic activity. In 1997, there was a low, characterized by a minimum number of sunspots. Credits: NASA.*

Let us first look at the properties of particles in the Sun's corona. When the Sun's corona is analyzed at its equator based upon the electromagnetic theory, there exists a remarkable phenomenon. The velocity of ionized particles in the Sun's local magnetic field above its surface at the equator is high compared to other places.

When such ionized particles move, they will screw about the magnetic field line and form a spiral path. Now, how active was the Solar magnetic cycle in 1997?

The activity was a low since 1995, see figure 11, characterized by a minimum number of sunspots. Moreover, the Solar magnetic cycle was aligned with the Earth's magnetism.

An aligned Solar cycle means that the magnetic field lines went from the North pole to the South pole the same way as on Earth. The ionized particles moved essentially from North to South or inversely, along the field lines, spiraling about them.

Seen from the Earth, this means that electrons and protons are oscillating forth and back, which creates an oscillating electromagnetic field, also in the direction of the Earth.

The electrons generate low to high-frequency fields, since the individual speed of the screwing electrons in the corona is estimated to reach up to 3×10^7 m/s [5].

The hot corona however also flows outside into the interplanetary space. This is known to be the solar wind. Bulk speeds of electrons around 72 to 450 km/s have been measured [5].

The electric field can be described by:

$\mathbf{E}(t) = \mathbf{E}\sin(\omega t)$ for each of its frequencies. (1)

The induced magnetic field is found with the Maxwell equation

$$\nabla \times \mathbf{B} \Leftarrow \mu_0 \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t} \quad (2)$$

whereof the field **B** is sinusoidal as well.

7. Effects of oscillating electromagnetic fields

It is well known that an oscillating electromagnetic field is able to get a conductor levitated because of the eddy currents that are generated in the conductor. These eddy currents create a counter-field that works against the initial electromagnetic field. And the counter-acting electromagnetic field acts at both the front and the back of the conductor. Levitation is however a specific situation when certain specific conditions are combined.

Now, the high-accurate gravimeter is shielded twice against electromagnetic fields, according to the manual. However, these shields are metallic and they are conductors, sensible to oscillating electromagnetic fields. When activated, they generate eddy currents with a counter-acting electromagnetic field at both the front and the back of the shield. As a consequence, the next shield will again generate eddy currents with a counter-acting electromagnetic field, which will be the inverse field of the former one, but weaker.

8. The measured electromagnetic depressions

In occurrence, the mass of the high-accurate gravimeter, made out of a conducting metal, tungsten, is more or less influenced by the oscillating electromagnetic fields, depending from the oscillation's frequency and the conductivity of the materials where they get through (fig.12.a).

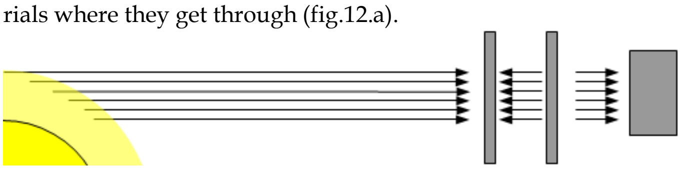

Figure 12.a. *When the corona emits an electromagnetic wave due to fast electrons, each time a conductor is reached, an inverse induced field is created. Even two shields don't prevent the mass of the gravity meter to be influenced.*

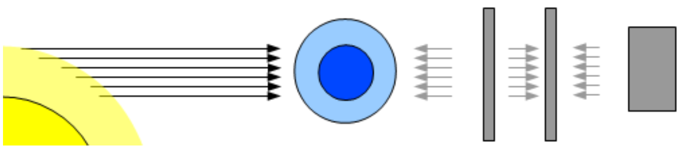

Figure 12.b. *When the iron core of the Moon intercedes, the electromagnetic wave is expected to be inversed, but because of the core's size, it is probably shielded.*

Each time that a conductor is reached, an inversion and a weakening of the field occurs.

But with an iron core such as that of the Moon, the electromagnetic wave is expected to be inversed, but because of the core's size, it is probably shielded, as shown in fig. 12.b. Then, the 'gravity' measurement is altered.

It is not surprising that the first depression is lower than the second, and that there is a small decrease of the measurements when the Moon's core passes the Sun's diameter. The bulk speed of the electrons in the corona is rotating together with the Sun while it spins. The first depression occurs at the Sun's side where the corona is moving away from the Earth. For the second depression, the Sun's corona is moving towards the Earth. The velocity of the Sun's surface could be the cause of the difference between both depressions. If so, this means that the electron's speed that comes in play for this effect is quite low.

The slow slope between the first and the second depression is logical because the 'amount' of corona at the front side of the Sun, when the Moon's core passes the Sun's diameter, is very limited (maybe 10 or 20 times lower) compared to that at the Sun's apparent edges, where an apparent accumulation of the corona's density appears.

9. Conclusion

The above analysis has shown that it is reasonable to further investigate the possibility that an electromagnetic effect was detected by the gravity meter during the eclipse that Wang observed. The combination of the four parameters: (1°) bulk electron speed in the corona, (2°) the spin of the Sun, (3°) the effect of electromagnetic transmission of oscillating fields through conductors, and (4°) the shielding of the Moon's core, gives a strong indication of an electromagnetic effect.

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