EXPERIMENTS USING THE FOUCAULT PENDULUM DURING THE SOLAR ECLIPSE OF 15 FEBRUARY, 1961

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A number of observations were made of the behavior of a Foucault pendulum during the eclipse of the Sun of 15th February 1961.

An experiment was performed to measure the variations in gravitational acceleration.

The pendulum's features were as follows:

- length 25.008 meters.
- Sphere's weight 5.5 kilograms with a diameter of 10 centimeters.

To avoid torsion of the ends of the wire, a connection was made by means of two torsionless silk rings.

The pendulum was oscillated through an angle of 4°. To reduce the error during the period of oscillation, the average was taken of three chronometers functioning simultaneously for 50 complete oscillations.

By this method, the average period was able to be determined within a margin of error of ±0.004 second.

The eclipse at Jassy (geographic coordinates: = 47° 11' N.; $1^h\ 50^m\ 14^s$ E.) commenced at $8^h\ 49^m\ 3^s.25$ and terminated at $11^h\ 16^m\ 50^s.35$. The maximum effect, whose magnitude was 0.973 cm/sec^2, took place at $10^h\ 0^m\ 37^s.71$ (official time in R.P.R.).

During the eclipse, the following average values were obtained for the period, T, and the acceleration of gravity, g:

Time hours:min	Observed Period, T (seconds)	g (cm/sec^2)
8:49	10.028 ± 0.004	980.78
9:13	10.028 ± 0.004	980.78
9:43	10.024 ± 0.004	981.56
10:00	10.019 ± 0.004	982.54
10:12	10.020 ± 0.004	982.34
10:24	10.024 ± 0.004	981.56
10:58	10.028 ± 0.004	980.78
11:10	11.028 ± 0.004	980.78

(The time shown corresponds to the start of each phase.)

It can be seen that *g* reached its maximum at 10^h.

The pendulum oscillated in the same plane until 10:08. At that moment a surprising fact occurred: the pendulum produced a perturbation by describing an ellipse whose major axis deviated in relation to the initial plane by approximately 15°. The eccentricity of the ellipse was 0.18. At the end of the eclipse the pendulum continued to maintain the elliptical oscillations, but the major axis approached increasingly to its initial plane. A similar result concerning a shift of the oscillation plane was obtained on 30th June 1954 by Professor Maurice Allais at Saint-Germain-en-Laye. We have, however, only indirect information regarding these experiments.[1]

Conclusions

A possible explanation of the observed variation in g could be the following:

During the eclipse, the moon exerted a screening effect on the attraction (gravitation) of the sun so that the attraction (gravitation) of the earth was indirectly increased. The phenomenon might also be studied

[1] Evidently unbeknownst to the authors of the paper, the work was published: M. Allais, 1957. Report of the Académie des Sciences of 4 December. – *Ed.*

by means of data regarding the tides, but such data is not available to us. The deviation from the pendulum's oscillation plane can be explained by the same hypothesis.

If the hypothesis of the screening effect cannot be verified, the variation in g might be considered as a result of diffraction of gravity waves. This latter hypothesis is only possible if the dimensions of the moon are comparable to the wave lengths of the gravitational waves. In which case the mass of the gravitons would be approximately 10^{-46}g (calculated by means of Compton's wavelength).

These experiments should be repeated during other total eclipses of the sun.