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LETTER TO THE EDITOR

Comments on "Illegitimate Science? A Personal Story"

It was a treat for us to read Bruce Maccabee's essay on his attempts to replicate the torsion pendulum experiments of Saxl and Allen (*Journal of Scientific Exploration*, Vol. 10, no. 2, 1996). Their experiments, however, are not completely forgotten, as Dr. Maccabee fears. Although references to Saxl and Allen's articles are mainly to be found in pseudo-scientific literature, they are occasionally mentioned in mainstream scientific literature (*e.g.* Gillies, 1987).

More important is that the experiments (with the original torsion pendulum of Saxl) were continued by Prof. J. Burns of the Florida Institute of Technology (FIT). It was his thesis that the observed diurnal variations in the pendulum period were caused by temperature variations in the supporting framework of the pendulum. This can result in small changes in the pendulum starting conditions, hereby altering the excitation of various modes of oscillation of the pendulum, other than the torsional mode. These modes are coupled to the torsional mode and can change it's frequency. According to Burns only the pendulum and the suspension itself were thermostated (*letter to M. Allen*, June 1986). During experiments at FIT no diurnal cycle was found (*private communication*, 1987). Since there was a better temperature control in the FIT lab, this seems to confirm Burns' temperature hypothesis.

However, according to laboratory notes of Dr. Saxl of September 2, 1974, the shortest periods he measured were at approx. noon, the longest at approx. midnight (35.823 versus 35.827 s). From our own experiments with torsion balances (balances, *not* pendulums) we have the experience, when we recorded the influence of environmental parameters, that usually the minimum outside temperature is at about 5 or 6 a.m. Therefore we regard it to be unlikely that minimum or maximum oscillation periods will occur at noon or midnight, respectively, due to temperature changes. Since Dr. Maccabee writes that the pendulum was mounted on solid bedrock in Saxl's house, in the basement we assume, we even expect a delay in the change of the lab temperature relative to the outside temperature. Also, if the temperature changes which occur during a solar eclipse have an influence on this pendulum setup, this will probably be a delayed influence, while Saxl and Allen's recordings show a more or less instantaneous response (Saxl and Allen, 1971). Temperature recordings taken in Florida during the same eclipse show that a local drop in temperature of 3°C occurred, but in a time course of about 50 min (Anderson *et al.*, 1972).

Alternatively, one might wonder whether the pressure changes in the atmosphere which are observed during a solar eclipse (Anderson *et al.*, 1972; McIntosh and ReVelle, 1984) can be held responsible for the pendulum response. A drop in air pressure (maximum values observed <10 mbar) will reduce the drag force on the pendulum and therefore decrease the pendulum period, contrary to what has been observed. The buoyancy effect, however, will increase the apparent weight of the pendulum disc and, according to the findings of Saxl and Allen (1969), therefore increase the pendulum period slightly. Using their Fig. 5, the increase in period is estimated to be 0.4 μs when the air pressure drops by 2.5 mbar (actual value observed during the eclipse, Anderson *et al.*, 1972). This is four orders of magnitude smaller than the observed increase in period.

Another interesting observation by Saxl was an abrupt "speed-up" of the pendulum for an interval of approx. 1.5 hours during a free run (*Burns, private communication*, 1987). These free runs were under the condition of free oscillation, contrary to the usual operation with release and capture after one swing of the pendulum disc.

Saxl and Allen have also published a study about the influence on the torsion wire length when charging the torsion pendulum with voltages up to 5 kV (Saxl and Allen, 1975). They conclude that the length of the wire is not affected by the electric charge. Maccabee's hypothesis of the "hole-in-the-shield", however, seems to be a much more likely conventional explanation of the "voltage effect" (Saxl, 1964) which is worth further investigation.

Finally, an attempt to incorporate the results of Saxl and Allen and those of Allais (1959) into an alternative gravitation theorie was performed by Kolesnikov *et al.* (1974).

Chris P. Duif and Kees Water
Haagwinde 49
1391 XX Abcoude
The Netherlands
chrisd@space-time.info

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