Undue responses in pendulum and gravimeter tests in solar eclipse days

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We report the detection of non-natural distant signals by two stationary pendulums in two solar eclipse days as opposed to extensive control data. This work originated as a gravity oriented research in the wake of published articles on alleged gravitational anomalies during solar eclipses, and as a follow-up to our participation in the 1999 NASA-coordinated global eclipse test whose results have never been published. This report comes late because, being biased by the original purpose and design of the tests, we had not understood the results of our observations until last year. We had a hard time in reaching an acceptable conclusion while strongly believing in the quality of our data. The tests were made in South Italy at solar eclipses of August 11 1999 and May 31 2003. Still to answer old open questions, in 2020 we re-sampled our 2003 records at a fast sampling rate (0.5 seconds) and found that the pendulum, stationary in the laboratory frame, exhibited micrometric movements that occurred in a precise temporal structure, that is, obeying a pattern of equally spaced time markers. We give neat evidence that there were no digitizing artifacts. The same 2003 temporal scheme was later found in our 1999 eclipse test as well, in gravimetric observations made at University of Trieste (Italy, 1999), and in reports from Reading (UK, 1999), Manavgat (Turkey, 2006), and Kiev (Ukraine, 2007). The results from Reading, Manavgat and Kiev had already been published but without any insights into the temporal structure, while the Trieste data is offered here in detail for the first time. We concluded that some non-natural signals were started and stopped in solar eclipse days in accordance to a common timing protocol, and were detected by various instruments in various distant locations over various years. We speculate that our apparatuses responded to artificial signals meant for other eclipse experiments. No such signals are present in our very extensive control data. Our findings call into question at least part of the published literature on the detection of presumed unknown features of gravity, and this is actually the purpose of this work. This article subtends suggestions on designing and interpreting such tests.

1 – Introduction

The main purpose of these pendulum tests was to check whether or not, during solar eclipses, they really existed some abnormal behaviors in instruments based mainly on hanging test masses, such as pendulums, spring-mass gravimeters, torsion balances. In summary anomalies have been reported at least as changes in local gravity by Q.S. Wang et al.[1] and D.C. Mishra et al.[2], changes of period of a torsion pendulum by E. Saxl et al.[3] and Luo Jun et al.[4], tilts of a special device used as horizontal gravimeter by T. Kuusela et al.[5], changes of period of a swinging pendulum by G.T. Jeverdan et al.[6], abnormal Foucault rotation rate of a swinging pendulum by M. Allais [7], spontaneous rotations of a special torsion balance by A.F. Pugach et al [8], correlated eclipse effects at a distance by T. Goodey et al.[9], an attempt to explain eclipse anomalies by T. van Flandern et al.[10]. We also mention the detection of periodic atmospheric gravity waves by K.L. Aplin et al.[11].

The stationary pendulum used for the May 31 2003 eclipse test (pendulum #2) was under-damped in oil, and had been characterized by a 50-day test in a non-eclipse season. Later in the solar eclipse day it showed an instability by far not consistent with the behavior observed during the characterization test, at a 5-sigma level. A striking feature in the eclipse test is the presence of quasi-instantaneous tilts of the pendulum in the West-East direction, in the order of a few micro-radians, followed somewhat later by returns to equilibrium through ordinary damped periodic oscillations. We emphasize that the behavior observed in the eclipse day was by far not representative of the ordinary behavior of that pendulum. The stationary pendulum used for the Aug 11 1999 eclipse test (pendulum #1) showed jerks synchronous with peaks found in a gravimeter trace recorded in Trieste 500 Km apart.

We report tests with pendulum #2 first, and the analogy with a trace recorded by Kuusela in Turkey in 2006 [5], because our understanding of the phenomena started just from there. In early 2000 the below described stationary pendulum #2 was installed in our laboratory for a planned long test. It remained operational until mid 2005, mostly undisturbed in the seldom attended laboratory. It was remotely monitored. As its behavior was not well understood, we decided to run a characterization test in order to provide a baseline for interpreting the observed data. The characterization test included of course not only the pendulum, but also the measuring means, the building and the environment. From now on, we will refer to the pendulum alone for simplicity, unless otherwise specified. Through this document we will present characterization test data and data for the May 31 2003 solar eclipse. As seen later in this document, at the occurrence of this eclipse the pendulum showed a quiet North-South trace, and a significantly disturbed East-West trace. For this reason, although we will give some N-S data too, we will focus our analysis on East-West data only. Unless otherwise specified, plots and data refer to the East-West direction. For the un-damped pendulum used in 1999 we will focus on apparent changes of the plane of oscillation and on some kind of vibrations. Furthermore, we will use data from other sources to highlight analogies.

2 - The pendulum #2 and the experimental site

The experimental site is located in Marigliano, South Italy, 40°55'41"N 14°27'55"E, local time UT+1. The site is in the Campanian plain, about 30 meters above the sea level, in a very stable building 26m long, 12m wide and protruding from the ground level by only 4.5m. The structure is built around a lattice of 19 steel-reinforced concrete pillars 30x50cm in size, connected by three orders of horizontal beams of the same material, the lower order of beams being 2m under the ground level. Urban traffic more than 200m away nowadays, less than 30 people in residential homes in a radius of 200m at the time of tests, no power grid lines in the vicinity, no cars but mine ever approaching the building. The diurnal thermal + tidal tilt of this building doesn't exceed 10 microradians, as measured during the characterization test. The pendulum was 2m long, with a period of about 2.8 seconds and, as shown in fig. 1-left, the motion of the bob was damped with oil. It had an anisotropic suspension and resolution better than 0.5 microradians; that is, for a 2 meter length, better than 1 micron. Data averaging gave better resolution.

Fig. 1 – Left: the damped bob of the pendulum. Right: the suspension

The bob was a brass cylinder, about 1kg; it was suspended by two parallel stainless steel wires 0.3mm in diameter, each being formed by 7 twisted thin wires. Distance between the wires about 6cm. Orientation of the plane of wires: North-South. A horizontal brass bar, screwed to the top face of the bob, carried at its ends two vertical cylindrical plastic tubes (open on top and bottom) which were immersed into two cups of oil for damping. All mounting accessories were made of brass. The bob was crossed through its vertical axis by an optic fiber 50 microns in diameter. The fiber was accurately and stably terminated at the level of top and bottom faces of the bob. A miniature light bulb injected light into the fiber from top, without touching it, of course; a bright 50 micron spot was then available at the bottom end. A camera was put under the bob, facing upwards toward the bottom end of the fiber. The camera was secured to a 10 Kg mass lying stably on the floor. The camera optics had been completely replaced by a microscope lens. A reference grid was permanently stored in the camera's internal memory, and was superimposed on the image. The camera was connected to a remote VCR and monitor, whose display looked like fig. 2. The bright spot is the 50 micron optic fiber. The grid is calibrated as squares of 20x20 micron, or 10x10 microradians for the 2m length. South and North are inverted. In order to prevent thermal shocks, the camera and the lamp stayed always switched on for the 5 years of the experiment, under uninterruptible power supply. The lamp needed replacement only once. In order to have an idea of air flows, we used a strip of magnetic tape hanging from the ceiling and parallel to the pendulum suspension and 30cm from it. No air turbulences were ever observed. The pendulum was placed in a central room in the basement having no walls facing outdoors. It was hanging from the ceiling (figure 1-right) and the bob was 1m under the ground level.

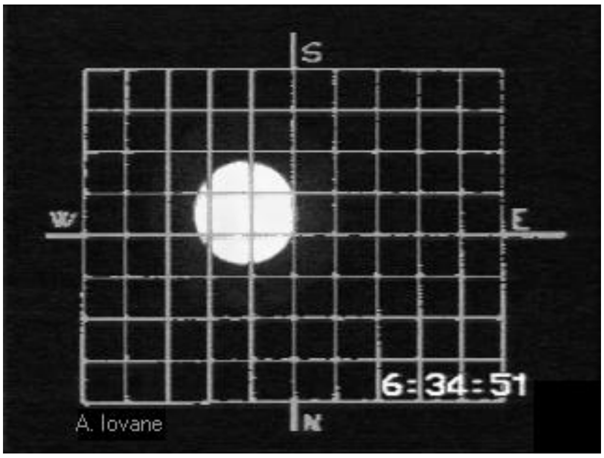

Fig. 2 – Snapshot of the video monitor showing the pendulum position

The temperature in the basement is very stable due to its structure: the average fluctuation in a day is 0.14° C and the peak 0.2° C, except spikes up to 0.5° C when it is seldom attended. The choice of this anisotropic design was due to the fact that we were not sure of the centering of the optic fiber within 1 micron to the vertical axis of the pendulum, and a long term torsion of a one-wire suspension would have affected readings. The observed amplitude of motions was in the range of fractions of a human hair diameter, and for these small magnitudes the above mentioned anisotropy seemed not to have any adverse effects.

3 - Results of pendulum #2 tests

The description of the characterization test is very useful to highlight the reliability of the whole system. This test ran from January 10 to February 28 2002. The eclipse test instead ran over the night/morning between 30 and 31 May 2003. For the observing site the partial eclipse begun before sunrise of 31 May. Eclipse data: Start (C1) at 02:19:28 UT on May 31 2003, maximum eclipse at 03:11:47 UT at an altitude of the sun of −04 deg, end (C4) at 04:07:12 UT. Local sunrise at 03:33 UT. Coverage: not applicable, as at mid eclipse the sun was below the horizon. Magnitude: 0.76.

Note on plotted data: for the eclipse test the y axis had been reset to a new arbitrary 0 but to scale. The characterization test y values all share a common arbitrary 0.

As a result of the characterization test, It turned out that the massive building, as tracked by apparent tilts of the pendulum, responded to outdoor temperature, leaning forth and back by a few micro-radians with a diurnal cycle. E-W and N-S components were present, with almost same amplitude (Fig.3 and Fig.4). For East-West, the correlation coefficient (Pearson) over the whole period, considering one averaged data point per day for both time-series and no corrections, was 0.93. We have also found that the building responded to temperature variations with a delay variable from 2 to 4 hours, i.e. it tracked the temperature curve with a variable offset of 2-4 hours. Further, the building smoothed the curve. The correlation coefficient computed over a 7-day sample period, considering one data point per hour for both time-series, was 0.72 after having shifted the data by a fixed offset of 4 hours.

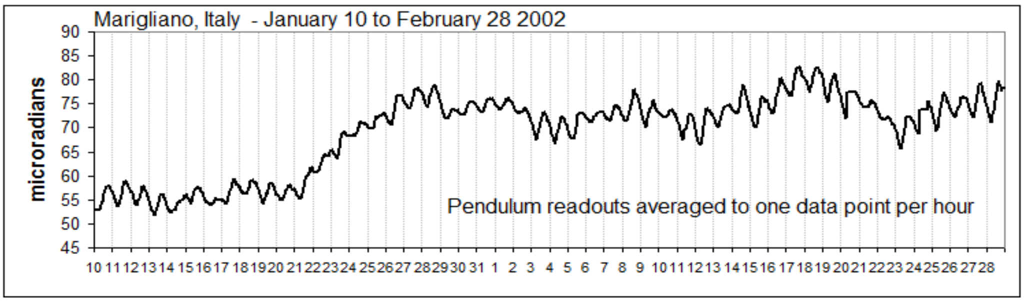

Fig. 3 – 50-day East-West pendulum oscillations relative to the tilting laboratory. Top is East

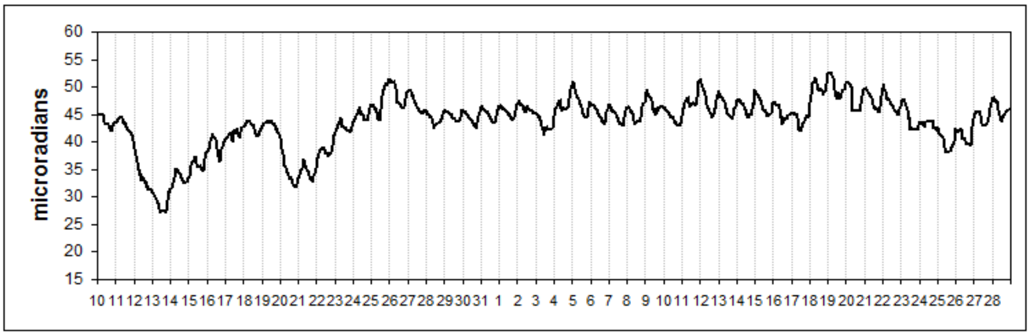

Fig. 4 – Same as Fig 3, but North-South. Top is South

The correlation computed on a hourly basis for periods of one day and after a best-fit offset correction for that specific day was typically around 0.85. The laboratory was quite well thermally damped, and even when there were no temperature variations therein, the pendulum performed its apparent diurnal oscillation however. Figs 3 and 4 show the pendulum's diurnal oscillations relative to the tilting laboratory over the 50 day period, Fig. 5 shows the correlation with temperature in the long term, Fig. 6 the correlation in the short term. Fig. 6 also highlights the phase offset between the two curves.

The 50 days are also charted in more detail in Fig. 7, with a close-up view on 28th day. Our averaging procedures lose seismic info. Two data losses were due to delays in changing the tape and fall outside the window of our interest.

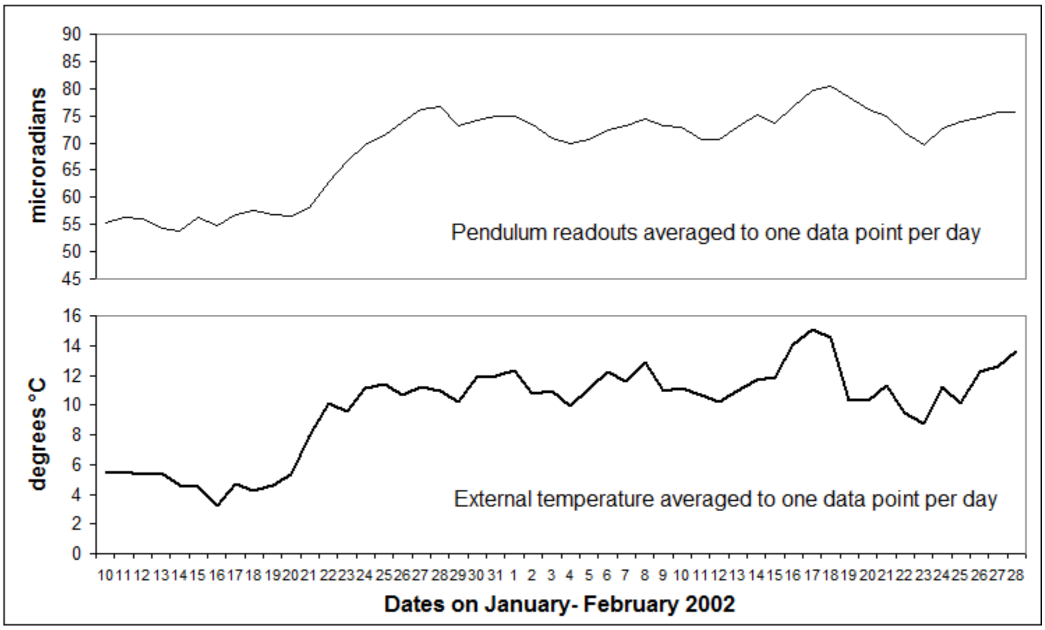

Fig. 5 – Correlation in the long term between pendulum readings and external temperature. Top is East

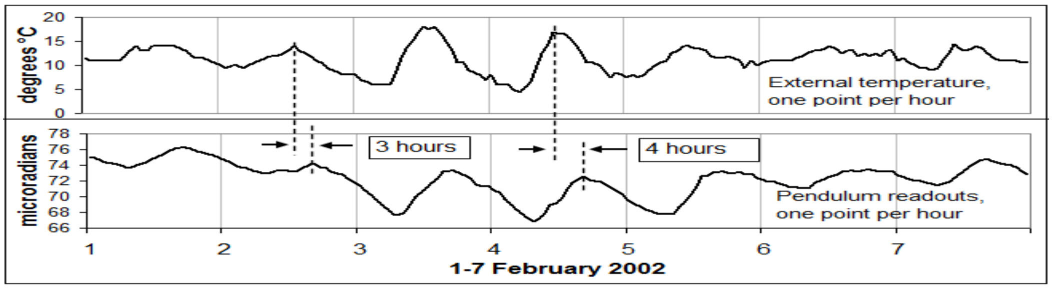

Fig. 6 – Correlation in the short term. Also seen the phase offset. Top is East

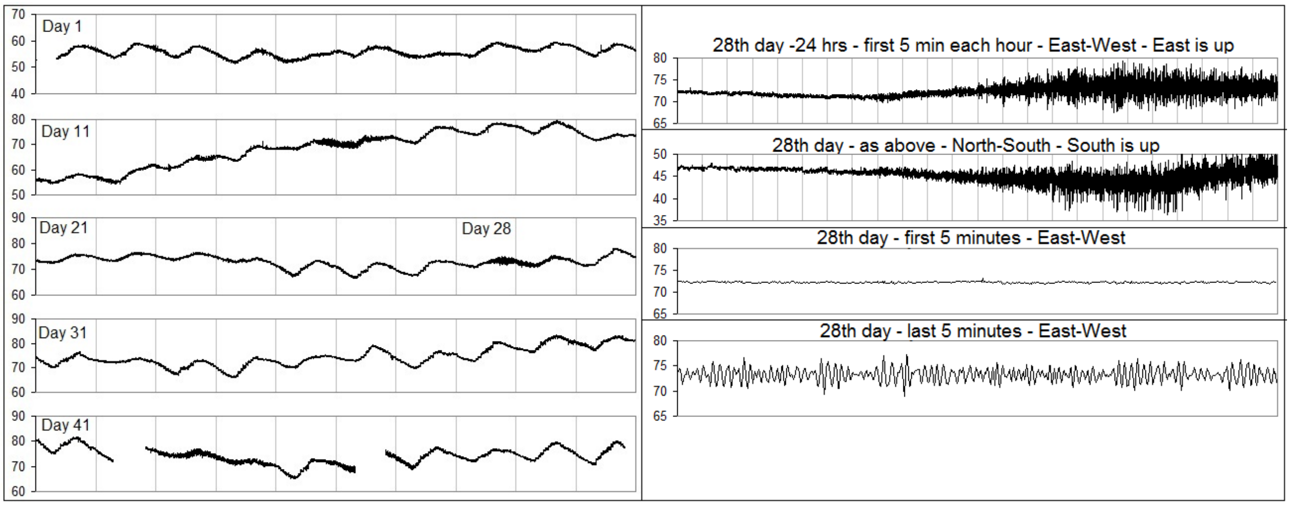

Fig. 7 – Left panel: the 50 days are charted in more detail, with data points averaged every 2.5 seconds. Right panel: the 28th day raw data.

Tidal effects were negligible as compared to thermal effects. Figure 8 shows the FFT analysis of the data. There is the strong 24h component and a weak 12h component which might include tidal effects, which are negligible for our purposes. The 12h and the 6h components might also include harmonic responses of the building. No further study was done on this.

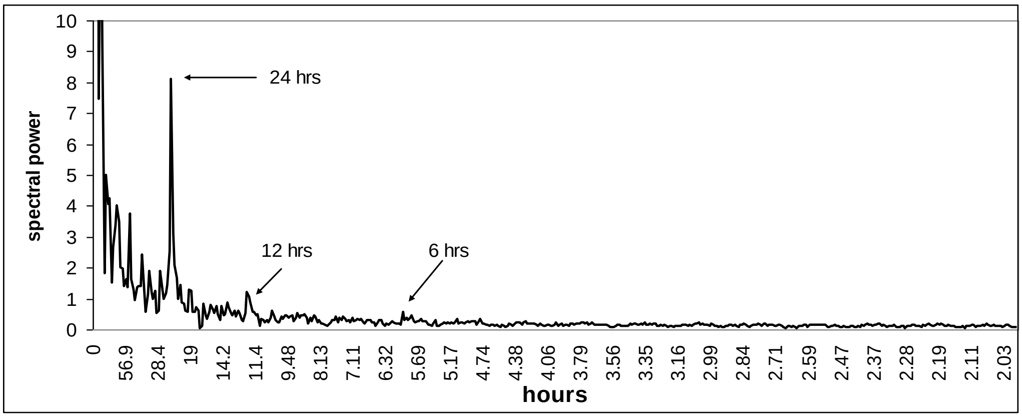

Fig. 8 – Fast Fourier Transform analysis of the data

The position of the pendulum was automatically recorded only for five minutes at the beginning of each hour in order to save on VCR tapes. The recordings have then been sampled and digitized by software, giving 0.5-second spaced x-y data. Note: each 5min recording episode actually gave 5 minutes less 7.5 seconds of data (585 points), due to delay in recorder response to the automated start commands. However in the narrative we will round to 5 minutes. Each 5-minute time series was then averaged to one single data point (hence 24 data points per day). At the occurrence of the 31 May 2003 solar eclipse, the position of the pendulum was recorded continuously for 8 hours comprising the 2-hour eclipse, from 22:00 UT of 30 May to 06:00 UT of 31 May. For homogeneity of processing, only the first five minutes (585 points, see above) of each hour were considered, and handled the same way as the 50-day control data. So the eclipse test gave 8 data points. Then, for the purpose of the comparison, from the 50-day time series only the homologous hours from 22:00 UT to 06:00 UT of each night were considered. So we had 49 8-hour segments (8 data points each) to compare with the eclipse segment (the first day, start of test, was incomplete). From each 8 hour segment it was subtracted its 2nd-degree polynomial fit in order to remove the smooth thermal effect. Then for each residual segment it was computed the standard deviation. Same procedure for the eclipse data. The process is graphically illustrated in Fig. 9 for two sample days and for the eclipse day.

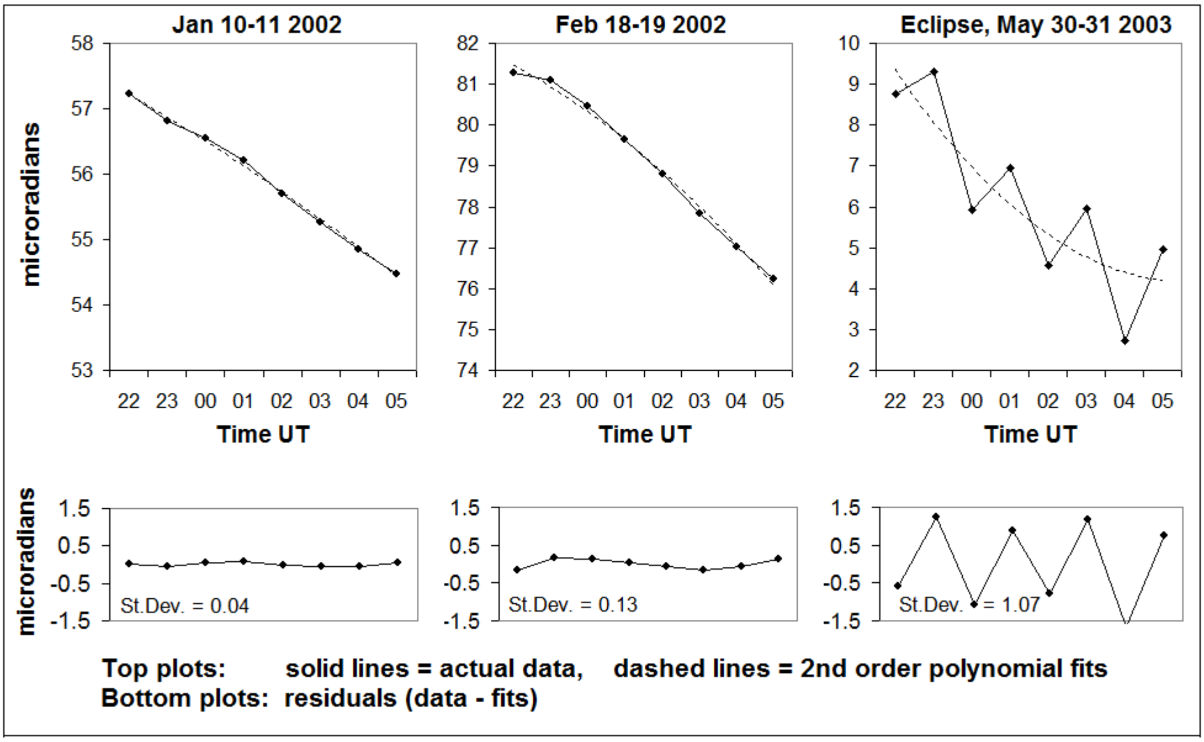

Fig. 9 – Graphic illustration of the data processing procedure. See text

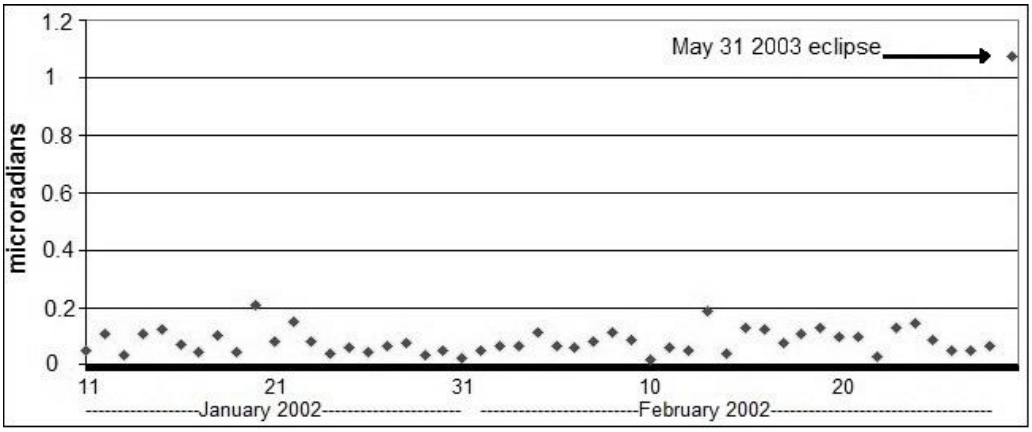

Fig. 10 – Dispersion of data in the control test and in the eclipse test. See text.

The final result is summarized in Fig. 10, in which the eclipse data is appended to the 49-day data. What is plotted is the standard deviation for the 49 days plus the eclipse day (the rightmost point). Note the huge difference in the dispersion of data: the eclipse test had a standard deviation of 1.07 micro-radians, about 5 fold the worst case of the control test.
The uncorrected results of the eclipse test are represented in two plots: Fig. 11 left panel for East-West, Fig. 11 right panel for North-South. The North-South trace is noisier and shows no signals of interest. Fig. 12 is a close-up view of the East-West data corrected for temperature by subtracting a best polynomial fit, and is the most significant figure in this article. Fig. 13 is the temperature in the lab in the same period. Fig. 14 is the external temperature plot covering the 8 hours of the eclipse test plus the previous 4 hours.

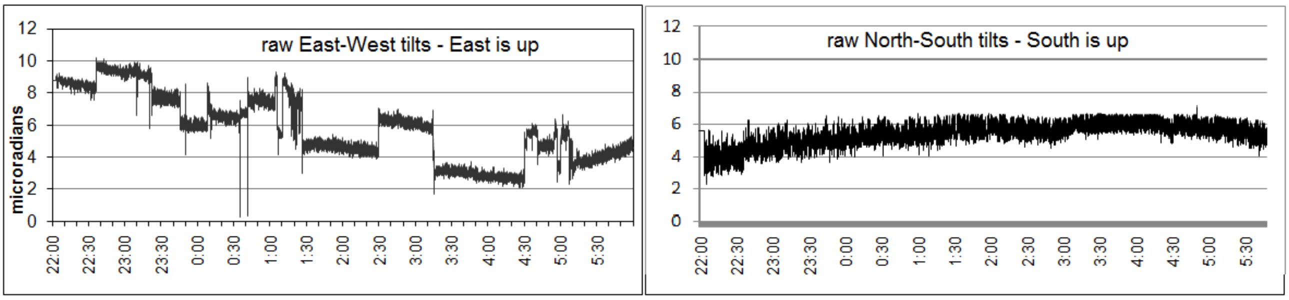

Fig. 11 – Uncorrected 8-hour continuous data around the eclipse.. East-West and North-South

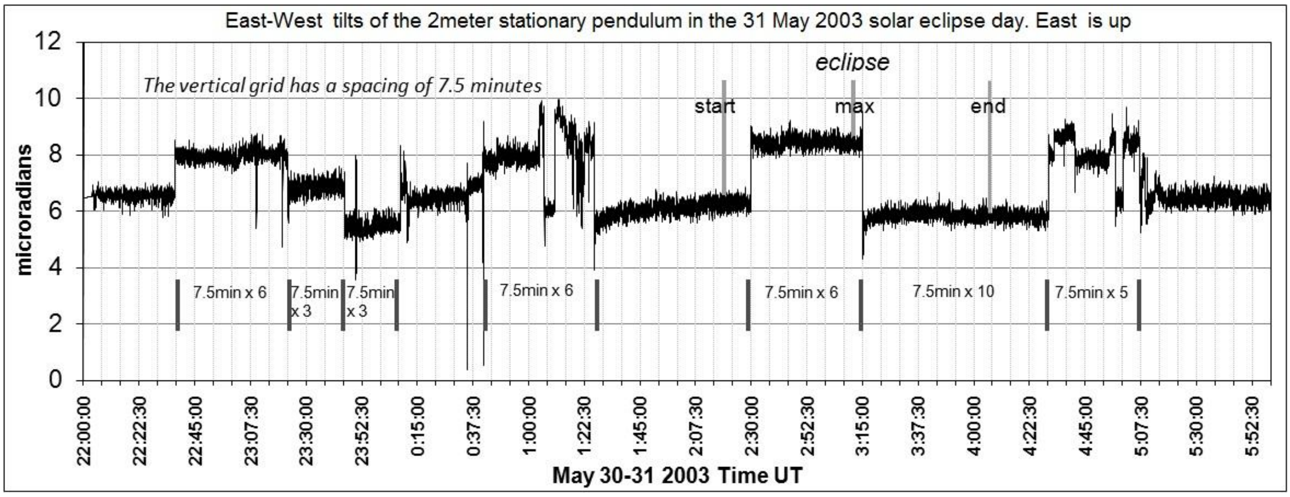

Fig. 12 – Temperature-corrected 8-hour continuous data around the eclipse. East-West

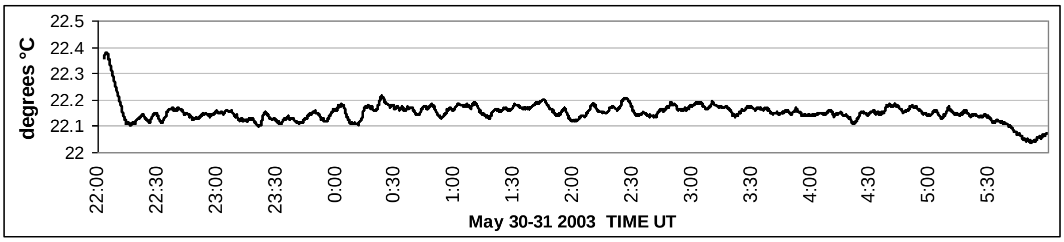

Fig. 13 – Temperature in the laboratory during the eclipse test

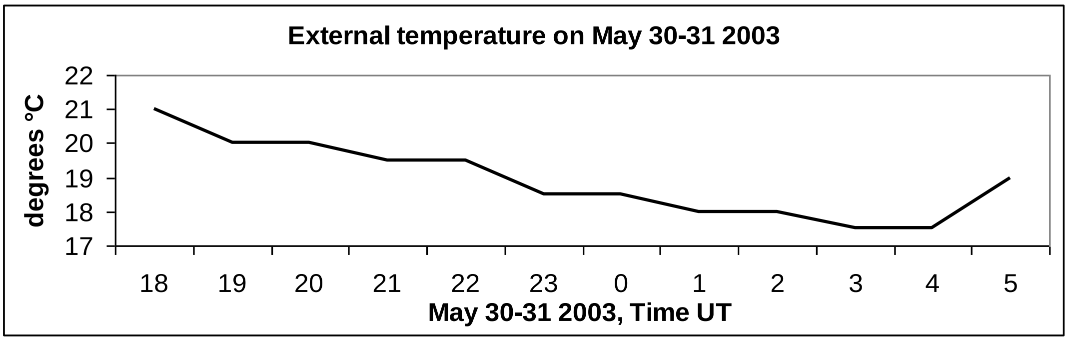

Fig. 14 – External temperature during the eclipse test plus the four previous hours

4 – Discussion on pendulum #2 eclipse result

There are three kinds of causes that could contribute to the observed effects: 1) instability of the reading apparatus and/or laboratory floor; 2) instability of the hinge point, meaning by this also the laboratory building and the surrounding environment and soil; 3) an external force acting on the pendulum. As for point 1, the reading apparatus and the floor are excluded because the apparatus tracked very well the period of the under-damped pendulum during trailing edges of pulses such as seen in Fig. 15 right panel. As for point 2, instabilities at the hinge point would have led local gravity at doing its work realigning the pendulum to the local vertical, making it oscillate a bit, but as seen in Fig. 15 the pendulum oscillated only at the occurrence of East-West (trailing) pulse edges and not West-East (leading) ones, which were quite instantaneous. Very slow seismicity, consisting into possible abrupt temporary but long lasting tilts of the soil, would fall into the discussion of this point. The recorded trace is not representative of tidal effects. As for point 3, it appears instead that leading (W-E) and trailing (E-W) edges didn't have the same cause, the first ones being caused by an external force acting on the pendulum, and the others being due to restoring action by local gravity when the cause ceased.

As said, there were no air currents in the lab, and however, if any, we don't see how they could produce these patterns. As for temperature, indoor and outdoor data have been given. We exclude possible local effects of shadow-related lack of any kind of solar radiation, because some anomalies appeared outside the eclipse window and before sunrise as well. Gravity as we know it nowadays can't account for such abrupt and spread displacements.

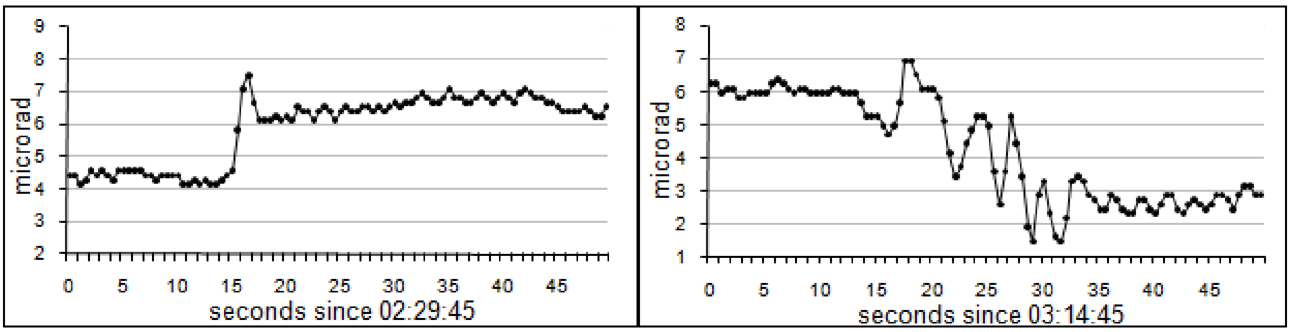

Fig. 15 – Details on the leading and trailing edges of the pulse at 02:30:00

The close-up view on two edges as on Fig. 15 shows that they were not digitizing artifacts. On Fig. 16 we give also the detail of the trailing edge at 03:15:00 UT at 0.1s sampling rate. Here the period of the pendulum is clearly seen.

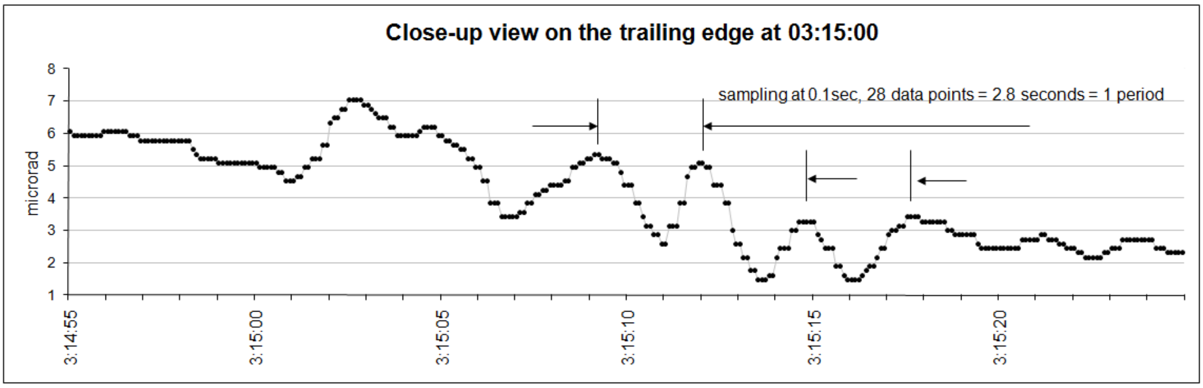

Fig. 16 – Close-up view on the 03:15:00 trailing edge

We have drawn up the following list of the times of some of the most significant pulse fronts seen in Fig. 12, from the actually recorded timestamps:
22:37:30
23:22:30
23:45:00
00:07:30
02:30:00
03:15:00
04:30:00
05:07:30
We noticed that all of the above times were multiples of 7.5 minutes since 00:00:00 UT, and based on this we drew the vertical grid in Fig. 12 that most of the pulse edges match. Some do not match but match a 2.5 minute spaced grid of which the 7.5 minute grid is a subset (the 2.5 minute grid is not drawn for clarity). So 2.5 minutes appears to be the root of a timing scheme, as a sequence of time markers every 2.5 minutes since 00:00:00 UT. Some pulses lasted 7.5 x 6 minutes, others 7.5 x 3 minutes, others 7.5 x 5 minutes, all starting and ending in accordance with the 2.5 minute markers.
This is not typical of natural phenomena.

5 – The Kuusela's results in Manavgat, Turkey, in 2006

The eclipse occurred on March 29, 2006. The tests were carried out by a team of scientists from University of Turku, Finland, headed by Tom Kuusela. The results were already discussed in their published paper [5]. In Fig. 17 we quote the trace they recorded in Location II (Manavgat) with a horizontal gravimeter in the East-West direction (East is up), such as published.

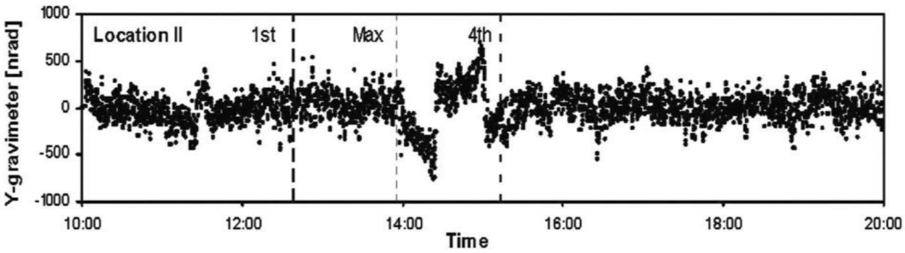

Fig. 17– Reported East-West tilt of the vertical during the March 29 2006, corrected

In this trace the pulse just after 14:00 UT is distorted by their filtering algorithms. On December 2020 we asked Kuusela for the uncorrected data, and they kindly sent them along with the permission to publish. The uncorrected trace looks like in Fig. 18.

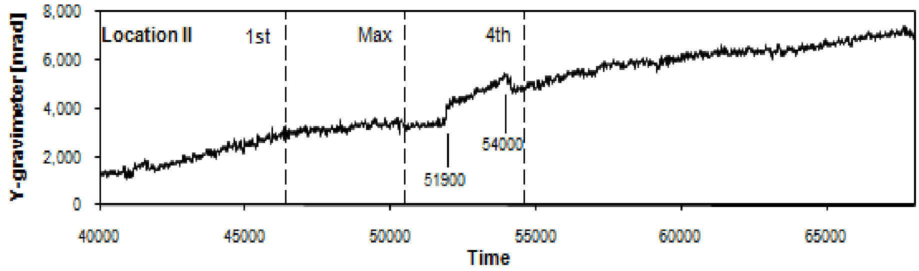

Fig. 18– Reported East-West tilt of the vertical during the March 29 2006, uncorrected.
The time is seconds in the day. 51900=14:25:00, 54000=15:00:00 – Duration 35 minutes

The pulse starts at second 51900 of the day (14:25:00) and ends at second 54000 (15:00:00). Both times correspond to 2.5 minute time markers as defined above. It is worth to note here that the duration was 35 minutes. Again the leading edge is fast and straight and the trailing edge is slow and wobbly. We basically apply here the same discussion as for pendulum #2.

This is not typical of natural phenomena either.

The Finnish team carried out simultaneous tests in three locations in Turkey, but the 35 minute pulse was observed only in Manavgat. This will be discussed below.

6–Pendulum #1 and Trieste gravimeter at the Aug 11, 1999 solar eclipse

Both of these experiments were done for NASA, see NASA page of October 1999 [12] still available on May 1, 2021, in which Trieste and Marigliano are mentioned as experimental sites. For the Aug. 11 1999 eclipse test we deployed our first stationary pendulum. (It is from this first experience that we got suggestions for designing pendulum #2.) The site and the building were the same as for pendulum #2, and the eclipse circumstances were: start (C1) at 09:21:08 UT, maximum eclipse at 10:47:28 UT, altitude of the sun 64 deg, 78.3% solar coverage, end (C4) at 12:13:43 UT.

The pendulum was 5.5m long. It was not damped. The suspension was made of stainless steel, 7x7 counter-twisted thin wires with an overall diameter of 0.9mm. The bob was a brass cylinder about 7cm in diameter and 14cm in height, weighing about 4.6Kg. All mounting accessories were made of brass.

The pendulum was installed in the staircase, and the bob was about 1m under the ground level. During the experiments the doors were sealed with tape, and the staircase was not used since the day before (there are secondary stairs on the opposite side of the building). The recording means consisted of a video camera with macro lens installed under the bob and facing upwards toward the bottom face of the cylinder. Concentric circles were drawn on that face, and a transparent reference template, solid to the environment, was placed between the bob and the camera lens. The camera was connected to a remote VCR and monitor. Figure 19 is a snapshot of the video. The circles and the radial line (torsion indicator) are on the bottom face of the bob, the central dot is 1mm in diameter, and the inner circles are spaced 0.5mm. The reference cross is on the transparent template solid to the environment. The marks on the cross are spaced 1mm. Spacing of circles and marks do not coincide in the images due to parallax effect.

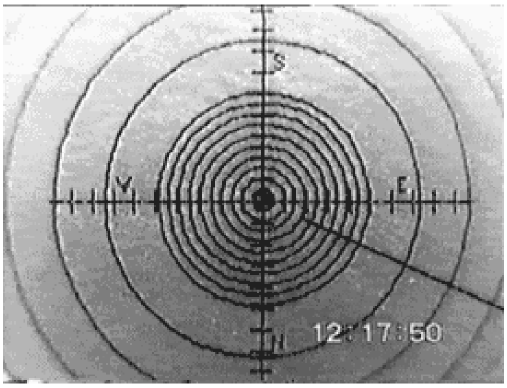

Fig. 19– Snapshot of the video permanently showing the bottom of pendulum #1.

Around the eclipse the pendulum always showed elliptical micro-oscillations with periods of about 4.7s, but the periods were often disturbed, the oscillations being abruptly reduced or widened. The amplitude ranged from almost stationary to nearly 80 microrad, with several changes. The oscillation was characterized by frequent rapid changes in the azimuth of the major axis. Control tests were made on August 24-25-26 around full moon, and September 8-9-10 around new moon. In these tests the always present motion was much quieter and less erratic, and the Foucault rotation was often observable over periods of hours, despite the small oscillations. In substance, the motion was by far less chaotic than on the eclipse day.

We will not go into deep analysis of the results, even neglecting possible eclipse effects if any, but will focus only on functional aspects for this article.

By mid August 1999 we wrote on a notebook the following notes, whose importance will be clarified later. It is important to note now that they were blind and unbiased.

Note1: From 08:28 to 08:42 major axis azimuth change > 20°

Note2: From 09:13 to 09:23 major axis azimuth change > 30°

Note3: From 09:40 to 09:53 major axis azimuth change > 45°

Note4: From 10:18 to 10:28 major axis azimuth change > 45°

Note5: From 11:28 to 11:38 major axis azimuth change > 30°

Note6: From 12:10 to 12:20 remarkable increment of amplitude.

The above notes were shared with NASA on August 21, when they had already received the tapes. This behavior was not understood, although it was reminiscent of previously reported observations [7]. After this first analysis we had a deeper insight but much later.

By mid September we got gravimeter data recorded at University of Trieste, courtesy of I. Marson and F. Palmieri. They used a well known LaCoste&Romberg Model D gravimeter. They didn’t publish the result because of the presence of a thermal drift in the data. In Fig. 20 there is their trace at 90 second resolution for an overall view of the three-day data.

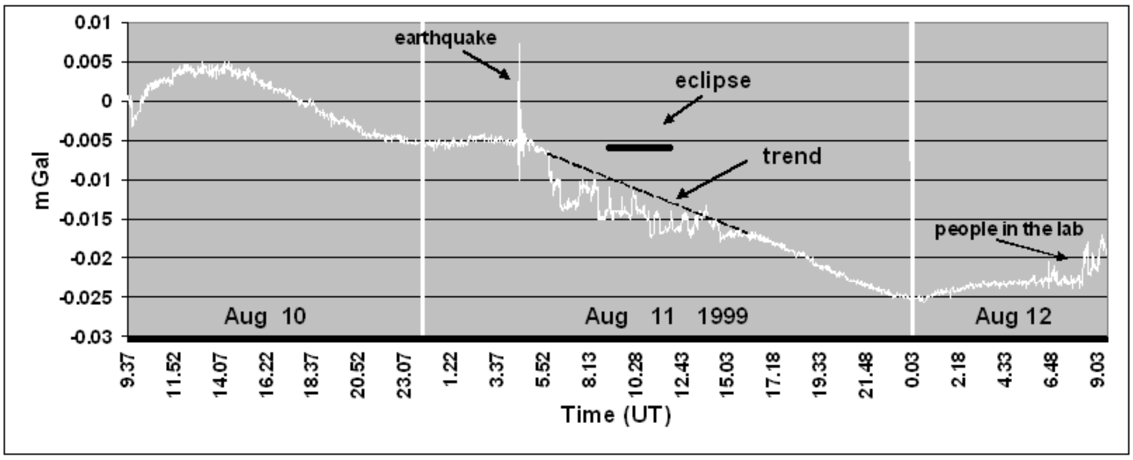

Fig. 20–Trieste gravimeter data at 90second resolution.

Fig. 21 is a close view of the central slice of the data at a resolution of 15 seconds. All the times come from the original timestamps. It is immediately evident that the falling edges of the pulse-like variations all start at 2.5 minute time markers (or 2'30" markers). Incidentally the dominant spacing between these edges is 35 minutes.

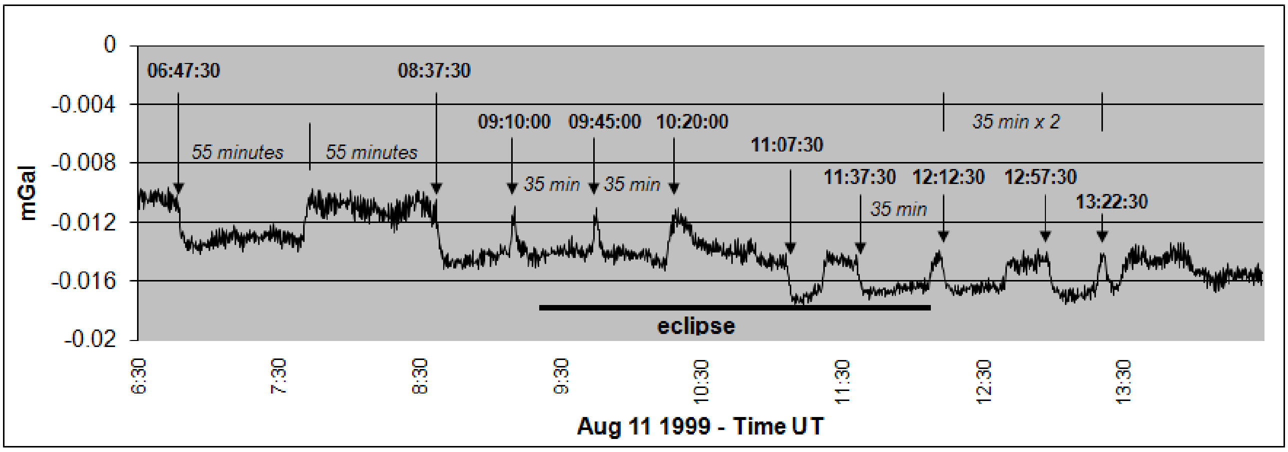

Fig. 21–The most relevant slice of the Trieste trace, with detailed timing info.

Edges at 08:37:30, 09:45:00, 10:20:00, 11:37:30, 12:12:30 fall within the time windows of notes 1-3-4-5-6 of the previous month (Note2 later proved inaccurate). This establishes a correlation between the gravimeter data and the pendulum#1 motion 500 Km apart. The mechanism that caused the variations of the azimuth of major axis became clear much later, after closely reviewing the pendulum video at the times of the falling edges in the gravimeter trace: the pendulum showed some vertical jerks in coincidence with the start of some of them. The disturbances appeared as brief oscillations between blurry and normal images within seconds as in Fig. 22 left and right panels. It is not easy to render the phenomenon on still frames, but it can be seen looking at the outer circles. The camera timer was set to UT+2 (local DST) and this is the vertical jitter of 09:45:00. We observed a total of eight of such short sequences, i.e. two just before the edge of 09:10:00, three around the edge of 09:45:00, one at the edge of 10:20:00 and two apparently uncorrelated minor ones. The length of these sequences ranged between 1 and 7 seconds, maybe depending on how much the suspension wire elasticity was involved time by time.

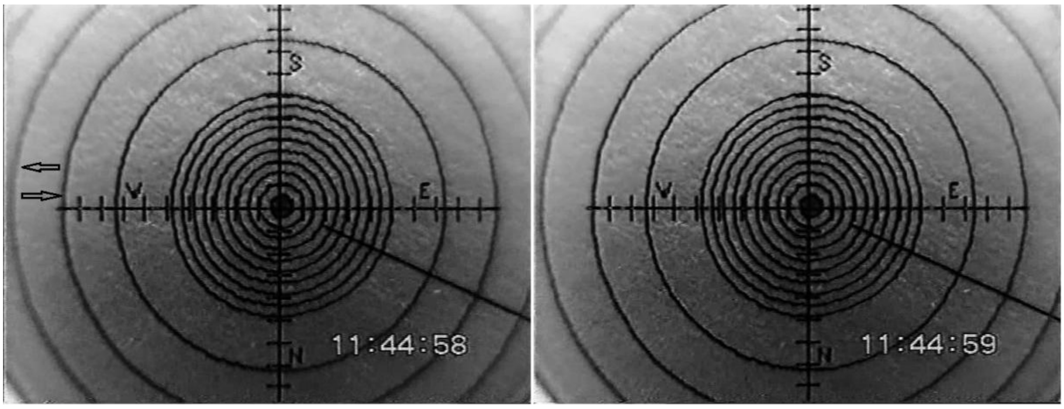

Fig. 22-A blurry image followed by a normal image one second later.
Look at the outer circles to see the difference. Timer shows UT+2.

Such vertical solicitations occurring over the course of elliptical oscillations around the vertical were very likely the cause of changes of azimuth of major axis. These episodes were not camera issues but actual solicitations to the pendulum: in fact it was at their occurrence that the azimuth changed significantly. As an example, between 09:45:00 less 1 minute and 09:45:00 plus 1 minute the azimuth changed by more than 45 degrees.
The Trieste data can also be correlated with the observation of atmospheric gravity waves with a period of 35 minutes which were observed on the same eclipse day by K.L.Aplin [11] in Reading (UK).
The above correlations exclude the possibility that the gravimeter and the pendulum responded to any local cause. In consideration of the non-natural timing scheme, natural gravity is ruled out as a cause. The gravimeter and the pendulum gave undue responses to something else. For the gravimeter, given that the trace doesn't represent gravity variations, we prefer to look at the upside-down trace, as in Fig. 23, so that peaks in the signal become dips.

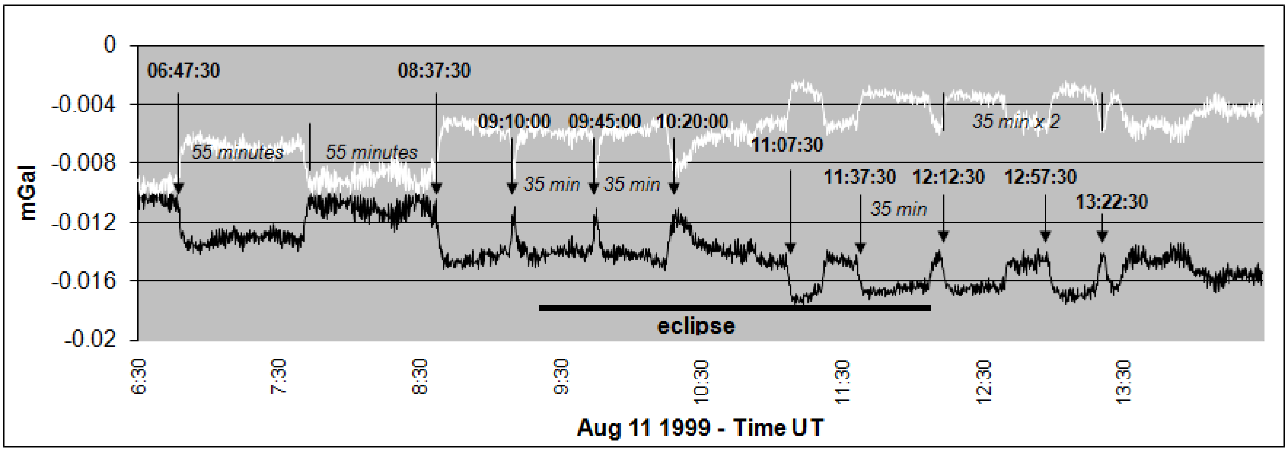

Fig. 23–Same as Fig. 21, but with mirrored trace added

7– Pugach's test at the September 11, 2007 eclipse in Kiev, Ukraine

Alexander Pugach of the Ukrainian Academy of Sciences performed several eclipse-related experiments. One of them was carried out in Kiev on September 11, 2007. He used a special torsion balance of his own design as described in the article [8]. Among others, we selected this article because in its Fig. 4 the time resolution is good enough to highlight that an abrupt deviation of the balance beam occurred at the 2.5 minute marker of 16:10 UT. See Fig. 23. We added markers at 16:09 and 16:11 for clarity. Again, an event at a 2.5 minute marker.

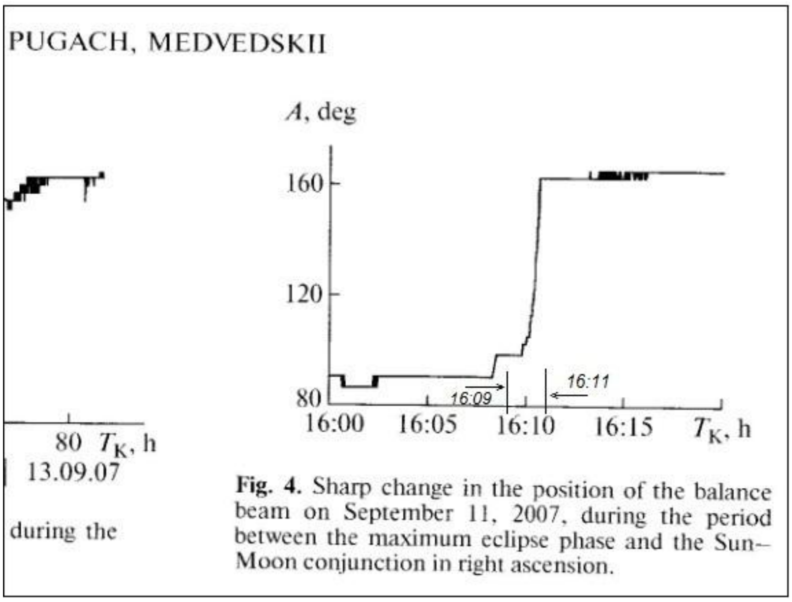

Fig. 23–Torsion balance beam rotation at 16:10 on Sep 11, 2007

8 – Overall Discussion and Conclusion

What we reported is strange but it happened. Given the common timing protocol and the spread over distances and years, it is undisputable that the signals the instruments responded to were of human origin, and were not local to the observing sites. By our current knowledge, mankind is still unable to manipulate gravity, hence the only possible nature of the detected signals was electromagnetic. The mechanism the instruments responded through is very likely that of currents induced in them and associated magnetic fields. Apart from direct signals, we see the possibility that some institutions used to excite, via powerful RF signals, modulated currents in the ionosphere in order to investigate its behavior at the occurrence of solar eclipses. The use of the ionosphere as a giant antenna is a known practice. Whether or not the gravity oriented instruments would respond could also depend on the structure of the buildings that housed them. For example, Kuusela used three identical instruments in three locations in Turkey, but only one responded to the time-structured rectangular pulse. The building structure may have developed its own eddy currents and related magnetic fields in response to incoming signals, and these fields may have interacted with the synchronous fields generated in the instruments, or conversely may have shielded incoming signals in other locations. Regarding the K.L. Aplin observations in UK [11], it is possible that ionosphere heating by RF signals (known phenomenon) has caused atmospheric gravity waves. It is not clear why a LaCoste & Romberg Model D gravimeter responded, because the test mass is in a shielded enclosure, but this happened. One might wonder if its electrical feedback circuit and cabling was affected by the incoming signal.
The purpose of this article is not to explain in detail the mechanisms nor to quantify (*) the observed phenomena, but to highlight the fact that some instruments designed for

gravitational tests / measurements responded unexpectedly to distant electromagnetic signals. We have come across artificial signals, but we think this shows that similar instruments could be affected (let's say disturbed) by ionospheric or even geomagnetic pulsations of natural origin, possibly caused by the moon suddenly eclipsing some solar fluxes affecting the ionosphere and / or the magnetosphere, leading to the wrong conclusion that the effects were gravitational. This may have happened in the past.
(*) Any quantitative data for undue responses is meaningless because the instruments were not calibrated for them.

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