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Nuclear Physics B (Proc. Suppl.) 124 (2003) 117–127

NUCLEAR PHYSICS B
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Detection of Dark-Matter-Radiation of Stars During Visible Sun Eclipses

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Recently a so-far unknown form of quantized, cold dark matter was detected on a laboratory scale which shows a complementary structure as compared to known forms of matter. From the experiments results that the observed quanta of the new type of matter as integer multiples of the Planck mass ($m_P = n \cdot \sqrt{h \cdot c/(2 \cdot \pi \cdot G)}$ $= n \cdot 21.77\,\mu$g, with n = 1, 2, 3 etc.) exhibit a spatially extended "field-like" structure ranging over distances of centimetres or more, opposite to the "point-like" structure of the known elementary particles of the standard model. Association of quanta of the new form of "soft" (or subtle) matter to clusters was observed, as well as re-clustering after absorption. Thus, between such quanta a physical interaction must exist. In addition, the new form of matter shows at least two interactions with normal matter, a gravitational one due to its real mass content and a so-far unknown "topological", i.e. form-specific, interaction at phase borders. Additional indications for a weak electromagnetic interaction exist. Furthermore, the experimental results reveal that some types of quanta of the new form of "field-like" matter exhibit positive mass, as normal matter, but others exhibit a negative mass content, both in the order of magnitude of the Planck mass. Memory effects in normal matter were detected after absorption of quanta of the new form of soft matter. In general, the findings characterize the quanta of "field-like" matter as WIMP candidates of a cosmic background radiation of cold dark matter (quanta with positive mass) as well as of a cosmic background radiation of dark energy (quanta with negative mass). During visible sun eclipses in 1989, 1996 and 1999, as well as during full moon of 6 January 2001, a so-far unknown form of dark-matter-radiation ("dark radiation") was detected. The quanta of this "dark radiation" travel with the speed of light, but reveal macroscopic real mass, with positive and with negative mass content. The presented method of experimentation offers a so-far unknown form of astrophysical observation, based on dark matter detection.

1. Introduction: Experimental Verification of a so-far Unknown Form of Field-Like Matter

The recent verification of the existence of a so-far unknown type of "field-like" (not "point-like") matter results from experiments to check the law of conservation of mass in thermodynamically closed chemical systems. In these experiments un-used 50 ml glass flasks, closed gas-tight, identical in volume within a range of $\pm 0.5\,\%$, and with a total mass of 100 or 200 g each, after preparation, served as thermodynamically closed systems. Metallic silver was generated from two homogeneous aqueous solutions within two test flasks with masses m_{T1} and m_{T2}, according to reaction (1), to generate a new phase border. Using a comparator (SARTORIUS C 1000) with a reproducibility of $c_R = \pm 2\,\mu$g, the masses of the two test flasks and of two reference samples with masses m_{R1} and m_{R2} which contained only water were determined automatically under isothermal conditions (reached about 5 h after the chemical reaction which was finished after about 6 minutes) sequentially in a special weighing cycle (index i) which took about 20 minutes. This weighing cycle was repeated for several weeks, respectively. The measuring effects, i.e. mass differences $MD_{k,i}$, for the two test flasks k = 1 and 2 were evaluated according to (2) [1][2][3] .

$$(C_5H_{11}O_5)\text{-CHO} + 2[Ag(NH_3)_2]OH =$$
$$2Ag + (C_5H_{11}O_5)\text{-COOH} + 4NH_3 + H_2O \quad (1)$$

0920-5632/03/$ – see front matter
doi:10.1016/S0920-5632(03)02090-5

$\mathrm{MD}_{k,i} = [(m_{Tk} - m_{R1}) - (m_{R2} - m_{R1})]_i - [(m_{Tk} - m_{R1}) - (m_{R2} - m_{R1})]_{i=0}$ (k = 1 and 2) (2)

In baseline tests with four identical samples without chemical reaction, the law of conservation of mass was confirmed within the experimental error, i.e. DM $\leq \pm 5\,\mu$g, see Figure 1 (Baseline). However, after silver-plating of the test flasks and after exclusion of any artefacts, highly significant deviations, i.e. DM $> |5|\,\mu$g, from the baseline, and thus from the law of conservation of mass were observed repeatedly [1][2], see Figure 1. Under the basic assumption that the law of conservation of energy is still applicable to the systems (and due to the constancy of Earth's acceleration during the experiments), the mass deviations of MD $> |5|\,\mu$g can be interpreted as due to the absorption of a so-far unknown form of matter with real mass (and energy) content by the test samples. Besides linear increases of the mass of the test samples also stepwise mass changes were observed repeatedly[3][4], indicating a quantized mass content of free quanta of the new form of matter, the density ρ of which could be estimated to be $\rho \leq 10^{-6}$ g/cm^3. The experimental results reveal, opposite to the "point-like" structure of normal elementary particles, a spatially extended "field-like" structure of this non-baryonic and non-leptonic, i.e. non-bradyonic, form of "soft matter" (soma).

Figure 2 shows the results of another test with internally silver-plated detector samples, compared to water containing references. As can be seen at the position marked "x" in section B (isothermal conditions are reached) a quantum of field-like matter with negative mass content is absorbed and emitted again, indicated by the negative peak. This process repeatedly occurs in section C while in section D, after the step of absorption no further emission takes place. The average mass difference between section B and D yields -21.52 μg $\pm$ 2.6 μg (95% confidence margin). This indicates the repeated absorption and emission (and thus existence) of quanta of field-like matter with a negative mass content in the order of magnitude of the Planck mass $m_P = |\sqrt{h \cdot c/(2 \cdot \pi \cdot G)}| = 21.77\ \mu$g. The peaks marked by "y" and "z", however, indicate the absorption and emission (and, thus, existence) of quanta (and associations of quanta) of field-like matter with positive mass content [2].

A gravitational interaction of non-bradyonic matter with normal matter, as well as a so-far unknown "topological" (i.e. form-specific) interaction at phase borders which is by a factor of about 10^{15} stronger than the gravitational one, were detected[1][2]. In addition, effects from an electromagnetic interaction with normal matter were observed, as well as an interaction between quanta of filed-like matter among others, to generate clusters. Due to the gravitational interaction stars should (on the basis of a relativistic gravitational potential) on the one hand build up a stationary field of non-bradyonic matter around its centre of gravity (with quanta of positive mass as well as with negative mass), penetrating the star's body and generating matter-field far beyond the stars surface. Because laboratory tests revealed that mechanical shock waves induce the emission of non-bradyonic matter from a sample after its absorption, stars on the other hand should, due to internal mechanical shock waves, induced by the process of the star's internal turbulent heat transport, emit a continuous flux of quanta of non-bradyonic matter with positive as well as with negative macroscopic mass. In order to detect this form of radiation, experiments were done, as described below, starting prior to, continuing during and after visible sun eclipses and under new moon conditions.

2. Results of Eclipse Experiments Yield the Existence of a Form of Field-Like "Dark Radiation"

2.1. Sun Eclipse of 12 October 1996

Prior to, during and after the partial sun eclipse of 12 October 1996, visible at the site of experimentation (Frankenthal, Germany, at 8 21' 24" east, 49 32' 06"), a test was performed (with so-far un-used flasks, under isothermal conditions) using a two pan balance (SARTORIUS M 25 D-V, total load 30 g at each side, reproducibility c_R

$= \pm 1\,\mu g$), comparing the mass of a spherical, internally silver-plated 30 ml glass flask (external diameter 4 cm), closed gas-tight, with a similar reference flask, containing water[4]. The test was started on 4 April 1996 and showed, from start-up until the sun eclipse on 12 October 1996, a significant smooth mass increase of the test flask to plateau values of more than $300\,\mu g$ after correction for buoyancy effects of the test and reference samples.

2.2. Discussion

In Figure 3, in addition, to the results of the measuring effects (time dependent and buoyancy-free Mass Differences, i.e. MD = m_T - m_R in μg) during the sun eclipse, the horizontal $\pm$ 95 % confidence intervals of the base line values of the measuring effect prior to and after the sun eclipse, and the time dependent percentage of coverage of the sun by the moon is given, normalised to a value of the ordinate of $13.5\,\mu g$ = 100 %, so that an optimal last square fit to the measuring values from 15:35 CET to 16:17 CET was achieved[4]. Furthermore, the positions of the vertical lines in the graph mark on the time axis the times t_M of closest approach of a background star to the centre of the moon during the moon's coverage, for all known background stars in the period marked by A and B. The position t_M and the corresponding minimum distance r_{CLO} for each star was determined from the known times of disappearance and re-appearance and from the two Ward angles of each star, see inset in Figure 3. The heights of the vertical lines represent I_{GEO} = (R_M - r_{CLO})$\cdot$100/R_M (with R_M as the apparent radius of the moon) of each background star, with I_{GEO} normalised to 16 μg = 100 % on the ordinate.

The achieved excellent last square fit between the measuring effects and the increasing coverage of the sun from 15:15 CET to 16:25 CET by the moon (maximum coverage 51.6 %) is consistent with the interpretation that the intensity of a flux of quanta of the new form of matter which is anisotropically radiated by the sun is during the sun eclipse amplified by a gravitational "lens effect" of the moon (see below) so that an increased exchange of real momentum from this flux to the test sample (acting in the experiment as a detector) is taking place due to the above mentioned topological interaction of soma quanta to the phase border of the test flask's internal silver-plating. The measuring effects for the sun can be described by a fitted Gaussian curve, see Figure 3.

However, before the measuring effects settle down reversibly to the baseline values at the right hand side of the point marked by B in the graph of Figure 3, they exhibit an additional characteristic pattern which is not correlated exclusively to the further covering of the sun by the moon. Rather, the I_{GEO}-/t_M-values run parallel to the peak values of detectable measuring effects. If Gaussian curves are introduced for simulating additional measuring effects, due to the covering of a background star by the moon (with the centres of these Gaussian curves being identical to the positions t_M of the vertical lines of the background stars as given in the graph), the width and the altitude of these Gaussian curves can be fitted, so that the characteristic patterns of the measuring effects can be met, see the given line in Figure 3. (Several of such individual Gaussian curves are given in Figure 3.) This is consistent with the interpretation that not only the sun is emitting a flux of quanta of the new form of matter (i.e. "dark radiation"), but also the background stars, respectively, and that every star's soma flux is amplified when covered by the moon during the time prior to, during and directly after the sun eclipse. This implies furthermore that the intensity of the stars' dark matter radiation (due to its non-linear, gravitational self-interaction) does not drop, according to $I(r) = I_0(r_0)/(f\cdot r_0)^2$ (for $f = r/r_0 > 1$) as electromagnetic forms of radiation do, but may follow a distance independent law of $I(r) = f'\cdot I_0(r_0)$ (with $f' = d/(2\cdot r_0) < 1$, where d reflects a fraction of a typical radius of a star r_0). This results in a thread-like network of soma flux lines between stars in a galaxy, between galaxies in galaxy clusters and throughout the universe, as recently observed[5].

The observed measuring effects, due to the observable intensity I_{EFF} of the soma flux of the sun and of background stars, can be furthermore described by (3a,b), where a_D characterises the detector's property to interact with the flux of soma quanta, I_{STAR} reflects the sun's or background stars' original intensity of soma radiation, $0 \leq f(\phi) = \exp[-(\phi/\phi_W)^n] \leq 1$ (for the sun $f(\phi) = 1$ results) describes the rate of transmission with regard to the rate of reflection in the scattering process of a background star's soma flux and the sun's stationary soma field (under the assumption of a spherical symmetry of this field, ϕ_W and n characterise the transmission behaviour, see below), where ϕ is for the case of a visible sun eclipse the observed angle between the centres of the moon and of the sun (for Figure 1: $0.2^\circ \leq \phi < 3.51^\circ$), I_{LENS} describes, according to (4a), the amplification of the sun's or background stars' soma radiation due the moon's "lens effect" at time t (with a_{LENS} as maximum amplification effect, t_W characterising the width of the Gaussian curve, t_M representing the time at maximum coverage of the sun or of the background star at apparent minimal distance r_{CLO}), angle φ is given by $\varphi = [(t - t_R) \cdot 180/(t_S - t_R)]$ with t_R and t_S being the times of moonrise and moonset (because only the vertical vector $I_{LENS} \cdot \sin\varphi$ acts on the balance pan), and A giving the moon's observable altitude. The observed measuring effects result from (5) (and were simulated on the basis of (3b) with the known values of $t_M(j)$, and adjusted values in Figure 1 for $a_0(j)$ and $t_W(j)$). The above defined individual values of I_{GEO} for background stars are linear approximations of I_{LENS}.

$I_{EFF} = a_D \cdot I_{STAR} \cdot f(\phi) \cdot I_{LENS} \cdot \sin\phi \cdot \cos A = a_0 \cdot \exp[-((t - t_M)/t_W)^2]$ (3a,b)

$I_{LENS} = a_{LENS} \cdot \exp[-((t - t_M)/t_W)^2]$ $a_0 = a_D \cdot I_{STAR} \cdot f(\phi) \cdot a_{LENS} \cdot \sin\phi \cdot \cos A$ (4a,b)

$I_{OBS} = \sum_j I_{EFF}(j)$, with j = 1, 2, 3 etc. for the sun and all background stars (5)

The results reported above indicate on the one hand that when the moon covers the sun or background stars there is an exact coincidence between the visible, electromagnetic radiation of the sun or of background stars and the described measuring effects MD, respectively. From this coincidence it can be concluded that the soma radiation (i.e. dark radiation) from the sun and from background stars travels at the speed of light. On the other hand the observed macroscopic effects, due to transfer of momentum to the detector in the eclipse experiment (or, in general, due to detectors' mass change[1][2][3][4]), indicate that the quanta of dark radiation exhibit rest masses which are non-zero, with a mass content which is of macroscopic magnitude. The above described "lens effect" by the moon cannot be due to a bending of the space-time structure around the moon as observed in the case of a total sun eclipses when the light of background stars with rest mass zero is "bent" by following a geodesic line in the bent space-time structure of the sun, in agreement with General Theory of Relativity[6] (GTR). For a gravitational lens effect of the moon the bending of a form of radiation which travels at the speed of light is given, according to GTR, by $\Delta\alpha = [4 \cdot G \cdot M_{MO}/(c^2 \cdot R_{MO})] \cdot [180 \cdot 3600/\pi] \cdot [(1 + \gamma)/2] = 2.59 \cdot 10^{-5}$ " (with mass $M_{MO} = 7.35 \cdot 10^{22}$ kg and radius $R_{MO} = 1.738 \cdot 10^6$ m for the moon, $\gamma = 1$ from GTR[6]), while $\Delta\alpha_{OBS} = 0.259^\circ$ is needed for an amplification, as observed. Thus, as **working hypothesis 1**, the bending and thus amplification of the flux of non-bradyonic radiation (i.e. dark radiation) emitted by the sun or by a background star in the moon's virtually flat space-time geometry is resulting from the scattering of these quanta in the moon's stationary soma field with mass m_{MO} if the centres of the sun and the moon as well as the position of the observer are oriented in line, i.e. if $\phi < 3.6^\circ$ (see below). If it is assumed that $m_{MO} \approx M_{MO}/100$ then the gravitational coupling G_S between soma quanta can be estimated from $\Delta\alpha_{OBS} = [4 \cdot G_S \cdot m_{MO}/(c^2 \cdot R_{MO})] \cdot [180/\pi]$ as $G_S = c^2 \cdot R_{MO} \cdot \Delta\alpha_{OBS} \cdot \pi/(4 \cdot m_{MO} \cdot 180) \approx 3.6 \cdot 10^7 \cdot G = 2.4 \cdot 10^{-3}$ $N \cdot m^2/kg^2$. *

2.3. Results from Sun Eclipse of 11 August 1999

To check this interpretation, another test was performed during the sun eclipse of 11 August 1999 with the above described comparator with an internally silver-plated 50 ml glass flask (with flat bottom, closed gas-tight, 100 g) as a test

* During the visible solar transit of Venus in June 2004 highly significant measuring effects could be registered, similarly to the lunar sun-eclipse results, which could be quantitatively explained by using the adjusted Newtonian gravitational constant.

sample (under isothermal conditions, exclusion of light, and recording of atmospheric conditions, as above) and was compared to the results of a baseline test independently done with a 100 g metal weight outside the sun eclipse. Figure 4 gives the results of the measuring effects (time dependent Mass Difference MD in μg), corrected for buoyancy effects and for a systematic drift of the baseline. The results of this baseline test as well as its +95 % confidence margins (due to the long term operation, the error is larger than the short term reproducibility) are given in the graph (-95 % values are symmetrical to the +95 % curve), indicating that prior to, during, and directly after the sun eclipse highly significant measuring effects up to about +1500 μg were detected.

2.4. Discussion

As can be seen from the depicted percentage of covering of the sun by the moon in Figure 4, from 11:13 CET until 13:54 CET (maximum 99.9 % coverage at 12:32 CET is normalised to 1100 μg = 100 % at the ordinate, the effect is significantly larger than the maximum effect of 16 μg of Figure 1 where maximum coverage of the sun was only 51.6 %) the measuring effects exhibit an intermediate maximum, coinciding with the sun's coverage, which thus can be interpreted (as above) as due to an increased flux of quanta of non-bradyonic matter, due to the moon's lens effect, detected by the test sample. As in Figure 3, the measuring effects of Figure 4 exhibit again a characteristic pattern, prior to and after the sun eclipse. As in Figure 3, for its explanation the given vertical lines in Figure 4 indicate (as described above) positions t_M and corresponding intensities I_{GEO} of maximum coverage of all known background stars by the moon from moonrise at 5:55 CET until moonset at 21:01 CET (which are normalised to 1100 μg = 100 % on the ordinate). Furthermore, the sinj values of the apparent height of the moon from moonrise ($\sin\varphi_{RIS}$ = 0 at 5:55 CET) through the maximum (sinjmax = 1 at 13:27:39 CET) until moonset ($\sin\varphi_{SET}$ = 0 at 21:01 CET) are given in Figure 4. Angle ϕ varied in this test in the interval $0.02° < \phi < 3.16°$.

In Figure 4 the overall shape of the measuring effects follows well $I_{GEO}\cdot\sin\varphi$, not directly depicted in the graph. (In Figure 3, $\sin\varphi$ varies from A to B less than 15 %, according to $\varphi = [(t - t_R)\cdot 180/(t_S - t_R)]$, with t_R = 11:41 CET, t_S = 21:14 CET, and $(t_S - t_R)$ = 573 min, in the interval $\sin\varphi$(A: t = 184 min) = 0.85 < $\sin\varphi_{max}$(16:27:30 t = 573/2 min) = 1 > $\sin\varphi$(B: t = 359 min) = 0.92 and is not given.) In Figure 4 the maximum of the measuring effect at about 11:00 CET correlates significantly to the relatively high density of star coverings from 10:30 CET until 11:30 CET. A superposition of Gaussian curves (adjusted in width and intensity, i.e. in t_W and a_0) for the coverage of the sun and of the background stars by the moon allows a perfect fit of the observed measuring effects prior to, during and after the sun eclipse. - The results of Figures 3 and 4 indicate the existence of quanta of field-like, dark radiation with positive macroscopic mass content. During a visible sun eclipse at 26 August 1988, using pre-used test flasks (which in other experiments exhibited memory effects from earlier tests!), a reversible reduction in weight indicated a solar flux of field-like, dark radiation with negative macroscopic mass content.

2.5. Results from a New Moon Test on 6 January 2000

Figure 5 gives the $I_{GEO}\cdot\sin\varphi$, results of a DM-test during new moon on 6 January 2000. Start-up was at 14 December1999, using the above described two pan balance with an internally silver-plated spherical glass flask as test sample with 5 cm external diameter and a water containing similar reference sample, both closed gas-tight. The test yielded a significant mass increase of the test sample until 6 January 2000 to plateau values of about 650 μg. Angle ϕ varied in this test for detectable soma fluxes of background stars on 6 January 2000 in the interval $2.26° < phi < 4.09°$. A superposition of Gaussian curves (adjusted in width and intensity, i.e. in t_W and a_0) for the coverage of the background stars by the moon fits highly significantly to the observed measuring effects, given in Figure 5. The likelihood p that by chance nine active stars exhibit t_M- and I_{GEO}-values which coincide with the maximum and the shape of the main peak of the experimental curve in Figure 5 is $p < 10^{-7}$.

2.6. Other Long-Range Correlation Reported

An anomalous plane shift of a pendulum was reported prior to the partial sun eclipse of 30 June 1954, visible at the test site in Paris[7]. Figure 6 gives the reported results[7] (marked as "curve AE") as well as the covering of the sun and of all background stars (in the form of IGEO as vertical lines at positions t_M) during this eclipse. Angle ϕ varied in this test in the interval $0.13° < \phi < 0.6°$.

With the known t_M(j)-values of the six background stars (including the sun) covered for an observer in Paris by the moon in the period from 11:00 UT until 12:45 UT on 30 June 1954, and estimated values for a_0(j) and t_W(j) of each star (index j = 1 through 6) in the order of magnitude of the data of Figure 1 (see legend of Figure 6), an expected measuring effect MD (i.e. mass difference between an internally silver-plated test flask and a water containing reference sample) can be predicted as depicted in Figure 6 as "curve MD". "Curve MD" leads to a highly significant correlation with "curve AE" in Figure 6, i.e. the observed plane shift anomalies of a pendulum during the same period. On the right hand side of Figure 6, an estimated (minimum) scaling, according to the results of Figure 1, is given for curve MD. Without taking into account the possibility for the simulation of curve MD and its estimated scaling, the likelihood p that by chance six and only six active stars (including the sun and background stars) exhibit t_M-values (and thus peaks in curve MD) which coincide with the six peaks of curve AE is $p < 10^{-10}$.

2.7. Discussion

This result, as well as the achieved correlation between curve AE and curve MD, indicates that the observed pendulum anomalies and the above described mass anomalies result from a common cause, i.e. the flux of soma quanta from active stars which is amplified for an Earth bound observer in sun-eclipse constellations, according to (3a,b) and (5).

The pendulum anomaly leads to the **working hypothesis 2** that soma fluxes from visible coverage of background stars by the moon prior to visible sun eclipses, lead to a transfer of macroscopic angular momentum by the background star's soma flux (besides the effect of its amplification) to an Earth bound detector of these quanta. This may be resulting from a circular polarisation of the soma flux, due to its reflection both at the stationary soma fields of the sun and of the moon in a time period of about 60 minutes before the maximum coverage of the sun by the moon. Because, as given in Figure 2, also during the "MD-test" on 11 August 1999 such a strong soma flux from background stars about 60 minutes prior to the maximum coverage of the sun by the moon was detected, it can be predicted that similar pendulum anomalies during this period should have been observable. However, in other sun eclipses where no background stars are located about 60 minutes prior to the maximum coverage of the sun by the moon, no pendulum anomalies should be detectable, even though "MD-tests" should yield significant results from the sun and from coverage of background stars after the maximum of the sun eclipse. These predicted statements of working hypothesis 2 can be verified in sun eclipse experiments in the future where tests with "Allais-detectors" and "MD-tests" are run in parallel, and, in addition, simultaneously at different places.

3. Conclusions

The results of Figures 1 and 2 are consistent with the interpretation that free quanta of field-like matter exist as an ubiquitous cosmic background radiation with positive and negative mass content in the order of magnitude of the Planck mass. Quanta of field-like matter with positive mass content are cold, "dark matter" WIMP candidates of such a cosmic background radiation of field-like matter. Quanta of field-like matter with negative mass content are similarly "dark energy" candidates of such a cosmic background radiation of field-like matter. The results of Figures 3 through 6 are consistent with (3a,b) through (5) and verify that besides the sun also background stars emit a kind of field-like radiation (i.e. "dark radiation") leading to significant macroscopic measuring effects MD if the moon approaches the sun under visible eclipse conditions, as seen from an Earth bound observer, at angles $\phi \leq 3.6°$, yielding with $\phi_W = 3.7°$ in $f(\phi) = \exp[-(\phi/\phi_W)^n]$ the exponential value n ≈ 60. The described experimental set-up implies a so-far unknown method of astrophysical observation, in general, due to the effect that active stars, such as the sun or background stars, emit besides the known electromagnetic quanta and particle forms of radiation also a detectable flux of dark radiation with positive or negative macroscopic mass content. It may be that the coincidence events observed in pairs of Weber's bar-detectors[8] were due to the detection of flashes of dark radiation and/or fluxes of quanta of dark matter originating from cosmic objects. This can be clarified by coincidence measurements between Webers original bar-detectors and weighing experiments using the above described silver-plated detectors.

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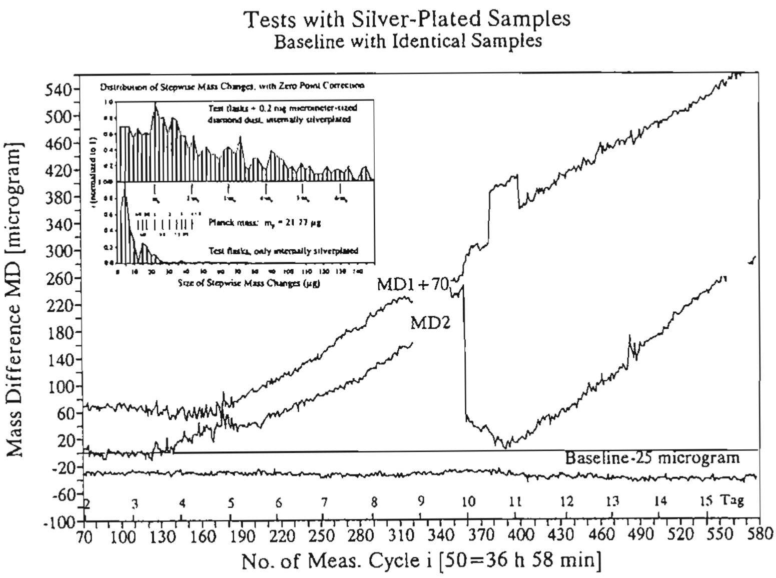

Figure 1. Measuring effects, i.e. mass differences MD (corrected for buoyancy effects) between an internally silver-plated, and gas-tightly closed test, and water containing reference systems, indicating the absorption and emission (and thus existence) of field-like matter with positive macroscopic mass content. The results of a typical baseline test were obtained with test and reference samples containing only water. The inset shows the distribution of stepwise mass changes of several tests, with a maximum peak at 21.5 μg, i.e. Planck mass 21.77 μg, and quantum numbers n and S of $m_P(\text{n, S}) = n \cdot \sqrt{h \cdot c/(2 \cdot \pi \cdot G)}$ which allow a further characterization of quanta of field-like matter.

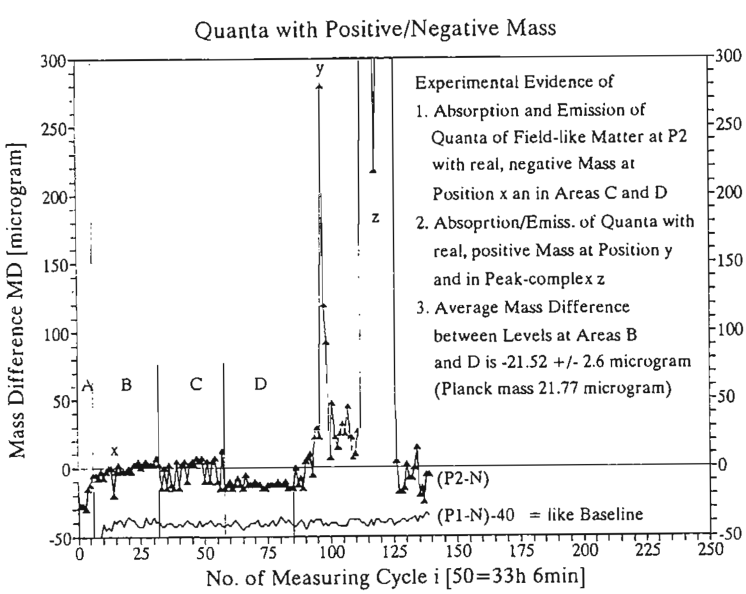

Figure 2. Measuring effects MD of a test with internally silver-plated test samples showing the absorption and emission (and thus the existence) of quanta of field-like matter with positive as well as negative macroscopic mass content at positions "y", "z" and "x".

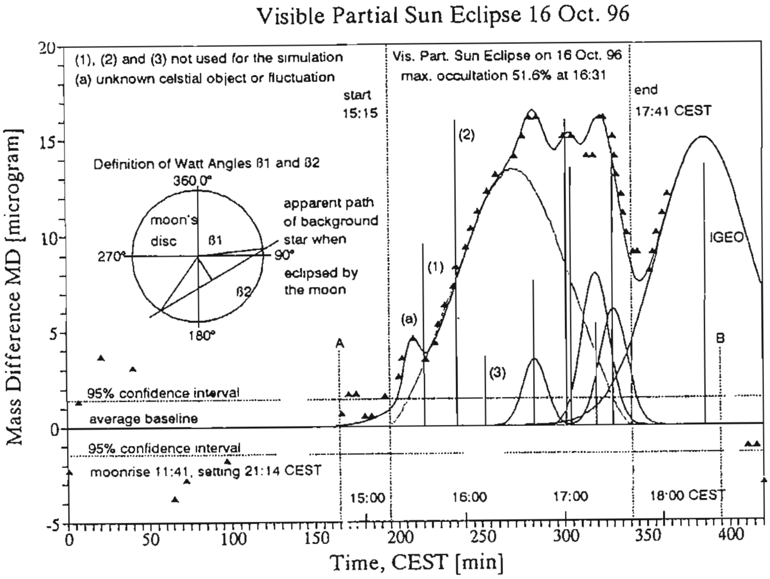

Figure 3. Measuring effects, i.e. mass differences MD (corrected for buoyancy effects) between a test and a reference system, during the partial sun eclipse of 12 October 1996, visible at the test-site, using a two pan balance (with a reproducibility of $c_R = \pm 1\ \mu$g), and an internally silver-plated 30 ml glass flask (closed gas-tight, used as "detector") and a similar glass flask as a reference sample, containing water. Besides the measuring effect, due to the covering of the sun by the moon (due to a gravitational lens effect of the moon), additional measuring effects due to the covering of the following background stars by the moon were observed (given are the star's code/name and individual values t_M [min], a_0 [μg], and t_W [min] as $t_M/a_0/t_W$ used for the simulation of the measuring effects): Sun 268/13.4/44.721, PPM 196280 281/3.5/10, PPM 705814 301/3.8/13.416 (including PPM 196294 at 304), PPM 196294 319/2.6/7.746, PPM 196307 330/6.1/11.832, and PPM 196332 385/15/40. From the inset the definition of the Ward angles for disappearance and re-appearance of a background star when covered by the moon can be seen. For further details, see text.

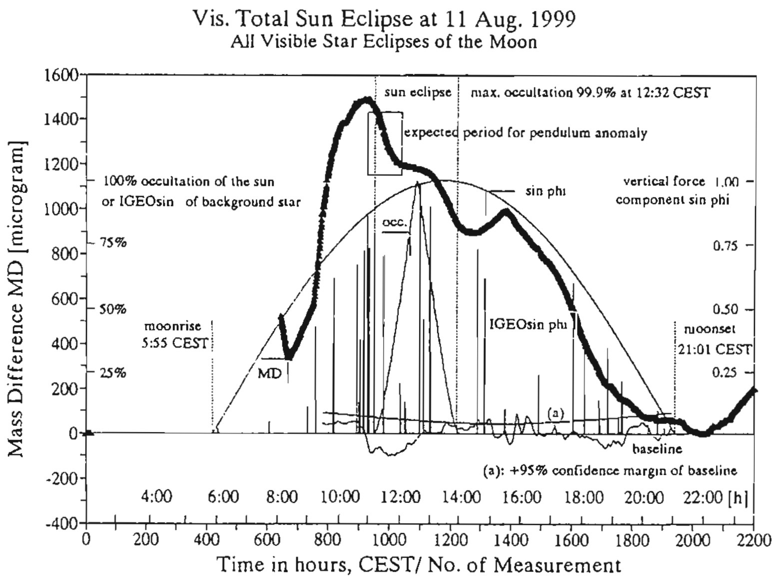

Figure 4. Measuring effects, i.e. mass differences MD (corrected for buoyancy and drift effects) between a test and a reference system, during the partial sun eclipse of 11 August 1999, visible at the test-site, using a comparator, and an internally silver-plated 50 ml glass flask ("detector"). For the determination of the baseline a 100 g metal weight was used. As in Figure 3, besides the measuring effect due to the covering of the sun by the moon (due to a "lens effect" of the moon), additional measuring effects due to the covering of background stars by the moon were observed. For further details, see text.

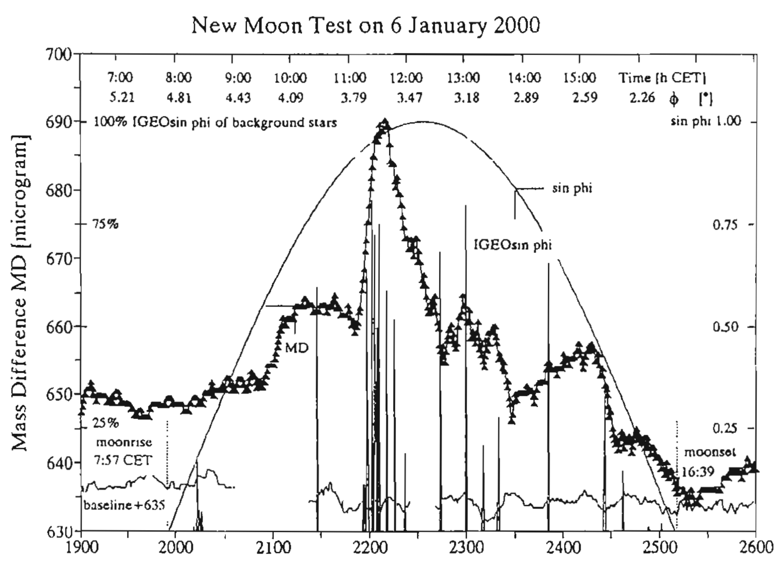

Figure 5. Results of a MD-test at new moon of 6 January 2000. New moon was at 19:14 CET, with $\phi_{min} = 1.27°$). The vertical lines give the positions t_M and intensities $I_{GEO} \cdot \sin\varphi$ of the background stars covered by the moon. For further details, see text.

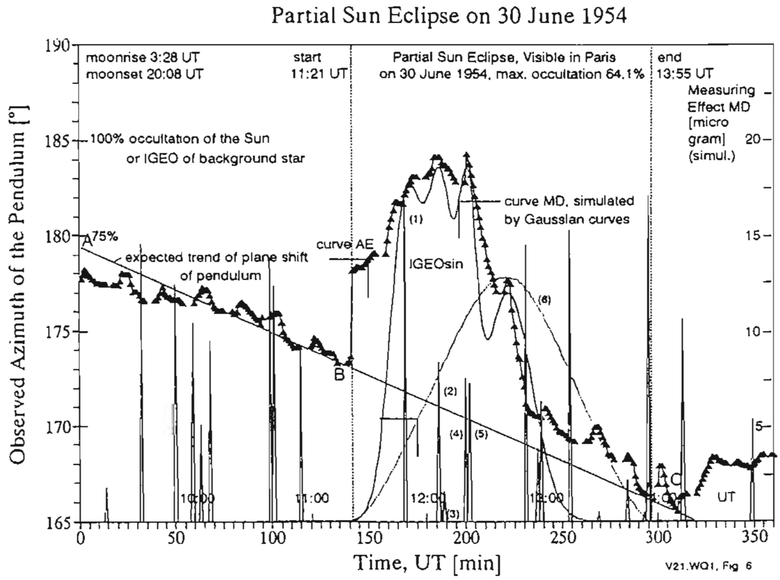

Figure 6. The graph gives as "curve AE" anomalous pendulum results[6] during the partial sun eclipse on 30 June1954, visible at the site of Allais' test in Paris, as well as the coverings of all background stars in the form of intensities I_{GEO} at positions t_M as vertical lines during this eclipse. For the simulation of a MD-effect ("curve MD" the following parameters of the six stars (1) through (6) and individual values t_M [min], a_0 [μg], and t_W [min], given in the following as code/name and $t_M/a_0/t_W$, were chosen: PPM 703977 169/17/11.83, PPM 96270 185/11/9.487, PPM 96281 189/6/7.746, PPM 96277 200/14/6.708, PPM 96279 202/0.5/1.732, Sun 221/12/17.32 (221/12/44.721 yields a simulation result, more realistic for a MD-effect).