EXPERIMENTAL CONNECTION OF MAGNETISM WITH GRAVITATION

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Abstract

A gravitational experiment is described which shows that the dipolar rod-like or needle-like mass test object made of the non-ferromagnetic material pivoted at its presumed center of mass in the gravitational field of the Earth assumes as the balance position the direction in the horizontal plane which is identical to the direction of the magnetic needle of an ordinary magnetic compass at that location, which obviously proves that the conventional Earth's magnetic field is connected with the Earth's gravitation and appears to be a manifestation of that gravitation. The photographs of that gravitational experiment are attached to this paper. Recently improved technique enables that this experiment can be readily and quickly demonstrated in any tightly closed room free of any air movement and temperature gradient.

The gravitational field of the Earth is an old established subject firmly based on the experiments of Galileo and Newton's theory of gravitation with many subsequent experiments. It must be noted that the experiments with gravity, i.e. gravitation, were done using a small mass ball, the legendary apple, small enough compared to the Earth, so that it can be treated approximately as a mass point. But the gravitational experiments with the asymmetrical mass objects, the dipolar structures pivoted in the Earth's gravitational field were not analyzed thoroughly so far, either experimentally or theoretically. They lead to some very interesting results, one of which will be described in details in this paper. Also, it should be mentioned here that the experiments with the pivoted gravitational dipolar mass structures made of the non-ferromagnetic materials in the conventional magnetic fields created by the electrical currents and in the inevitable Earth's gravitational field lead also to some very interesting results, which will be the subject of a separate paper.

This author has performed since 2002 in the tightly closed, avoiding any air movement, living room in his apartment on the 4th floor of a high-rise apartment building in the very steep portion of the Balkanska Street in Belgrade, Serbia, just below the Terazije plateau, the center of the old Belgrade, a large number of experiments with the various gravitational dipolar mass structures made strictly of the non-ferromagnetic materials appropriately pivoted in the Earth's gravitational field. Friction was a very serious problem in all those experiments. One such experiment, which was repeated many times, will be described here in all details with the photographs as the documents of that experiment.

A gravitational dipolar needle (or rod), a g.d. needle for short, is defined as an elongated mass object with the non uniform mass distribution along its length, with more mass at one end compared to the other end, so that its center of self-gravity and its center of mass are clearly apart as much as possible, made strictly of any non-ferromagnetic material, like bronze, aluminum, etc. The g.d. needle used in this particular experiment was cut from the precisely rolled bronze sheet 0.2 mm thick, in the form of a very elongated trapezoid with one side 12.5 mm, the other side 3.7 mm and the length 107 mm and the total mass 1.3 grams with the obvious non uniform mass distribution along its length. Many similar needles were also used.

For pivoting of the above described g.d. needle, a pedestal was made of aluminum by high precision machine in the form of a precision rectangular parallelepiped with the rectangular base 15 mm x 16 mm and the height 20 mm. To one vertical side of that aluminum parallelepiped a bronze cylinder of the length 35 mm and diameter 2.8 mm was attached by the 3 mm standard machine screw and the appropriate bracket in the strict vertical direction. Into the upper end of that vertical bronze cylinder the axle of the balance wheel of a small watch was set on a high precision small lathe coaxially. The tip of that balance wheel axle has the diameter of about 75 microns, with its top end in the form of a somewhat irregular calotte as observed microscopically, and the tip of that calotte is the pivot point of that aluminum pedestal, whose total mass is 13.2 grams.

On the top of a small wooden table with four legs placed in parallel with the walls of the living room, whose flat square top was checked and adjusted by the level instrument, the rectangular aluminum rolled flat plate of the thickness 1.2 mm and the sides 182 mm and 333 mm was placed and properly electrically grounded with the standard alligator clip and the appropriate wire. The above described aluminum pedestal was placed at the middle of that aluminum plate with a German made magnetic compass at one side. The above defined g.d. needle was slightly curved downwards to set its center of mass slightly below the intended pivot point. When that curved g.d. needle was placed on the flat horizontal plane, its apex-height was measured about 4 mm. That curvature of the g.d. needle is essential for stability and the possibility to place that g.d. needle without any bearing on the pivot point of the described aluminum pedestal, so to assume the horizontal position and free to turn. Note that the g.d. needle was cut from the precisely rolled bronze sheet with the very smooth surface without any scratch whatsoever. It is obvious that an appropriate dent on that g.d. needle would be helpful for the placement of that g.d. needle on the pivot point, but it was found experimentally that any such dent introduced extra friction and rendered such a g.d. needle

useless for this experiment. The ruby bearings as used in the watch industry and the manufacture of the ordinary magnetic compasses were also tried to attach them on the g.d. needle, but since those rubies are electrical insulators, the inevitable electrical charge interfered, making the desired experiment impossible. So, it was decided to try to place the above defined bare g.d. needle without any mark or bearing on the pivot point of the pedestal so to assume the horizontal position and to be able to turn freely, and grounding that g.d. needle electrically by that procedure. That task to place the described bare g.d. needle on the described pivot point looked at first almost impossible, but it was done after a great deal of patience and trials, and a great deal of time. It should be mentioned that oiling was tried to reduce friction, but found counterproductive.

It was very interesting to watch the turning and trembling of the g.d. needle when it was placed on the pivot point in the horizontal position and free to turn. The turning of that g.d. needle was quite slow, and when it was over, it was observed that the direction of that g.d. needle was identical to the direction of the magnetic needle of the magnetic compass nearby, with the sharper and longer end of that g.d. needle pointing towards the magnetic North, and the obtuse shorter portion of that g.d. needle pointing towards the magnetic South. It was observed that the g.d. needle turning depended on the way how the placement of the g.d. needle on the pivot point was done. If the placement was done so that no angular momentum whatsoever was imparted to the g.d. needle, so that its turning began with the zero initial angular velocity practically then the turning was quite slow to start and ended when the balance NS direction was reached without any overshoot of that NS direction. The turning was clockwise if initially during the placement the sharp end of the g.d. needle was towards the West, but counterclockwise if initially the sharper end was towards the East. The placement without imparting any angular momentum to the g.d. needle was much more difficult to obtain than the placement when unintentionally the very slight initial angular momentum was imparted to the g.d. needle, in which case the turning started immediately after the successful placement and was swifter and usually overshot the magnetic NS direction and stopped, and then returned quite slowly to the balance NS direction, occasionally with the additional very slight overshoot. The time of the turning of the g.d. needle to reach balance position, i.e., the NS direction, varied quite obviously from day to day in the repeated experiments depending on temperature and humidity which probably changed friction at the pivot point. The very slight occasional trembling of the building due to the traffic also influenced friction. On the average, the time was roughly about 30 seconds but not infrequently longer, even up to few minutes. It must be mentioned that once the g.d. needle reached the balance magnetic NS direction, it remained in that position indefinitely, even for

hours, until some even slight air movement or occasional building trembling due to various causes induced the g.d. needle to drop. These repeated experiments required the extreme patience and a great deal of time, but they yielded the almost incredible but inexorable conclusion that the Earth's gravitational field, which obviously determined the movement of the g.d. needle, is connected obviously with the conventional Earth's magnetic field, which appears to be a manifestation of the Earth's gravitational field.

As the check of the verticality of the vertical bronze cylinder with the pivot point, this author holding breath and extremely slowly turned by sliding the pedestal with the g.d. needle on the pivot point in the balance position (the magnetic NS direction) plus and minus 90 degrees. It was observed during that turning of the aluminum pedestal that the g.d. needle trembled and turned somewhat, but remained within +- 10 degrees around the magnetic NS direction, which shows that the accuracy of the vertical line of the pivot is reasonable, if not ideally exact. In the ideal case, the g.d. needle would not turn at all with the turning of the pedestal carrying that g.d. needle. Friction was probably responsible for slight turning and trembling of the g.d. needle when the pedestal was being turned.

The above described experiment was repeated recently for the purpose of taking photographs. The photographs of that g.d. needle in the balance position (the magnetic NS direction) as shown by the nearby magnetic compass were taken with the digital camera by Mr. Miroljub Simic, professional photographer and iconographer, Vukasoviceva 58, 11090 Belgrade, Serbia, who observed the entire experiment. Two of those photographs are attached to this paper. A lying slimmer g.d. needle of 0.9 grams is observed on the first photograph, whose placement on the pivot point is very, very much more difficult. It yielded the similar results as the used more massive g.d. needle of 1.3 grams.

It is obvious from the above descriptions that these experiments cannot be performed before an audience in public for demonstration and for the measurements in the field. This author was glad to learn from a young electronic engineer Mr. Andrija Radovic, Nike Strugara 13a, 11030 Belgrade, Serbia that a young Sebian mechanical technician from Sremski Karlovci, Serbia Mr. Nebojsa Kovacevic (e-mail: morfeus@eunet.rs) constructed and assembled an apparatus with the magnetically levitating vertical axle which rotates without any friction whatsoever carrying even up to 600 grams, and is insensitive to any externally applied conventional magnetic field. Mr. Kovacevic used that apparatus for monitoring the slight variations of the direction of the conventional Earth's magnetic field by attaching the ordinary magnetic needle from a magnetic compass to the vertical axle of that apparatus. This author told Mr. Radovic that such an apparatus could be very useful to

perform rather swiftly and conveniently the experiments as described above. Mr. Radovic tried that with Mr. Kovacevic in Sremski Karlovci, but Mr. Radovic told this author that they obtained some strange results. So Mr. Kovacevic brought his apparatus for demonstration in the above mentioned apartment of Mr. Radovic, and this author was present there for demonstration and experiment on November 28, 2005. Mr. Radovic was trying to attach a wooden rod of about 150 mm length with the square cross section about 6 mm x 6 mm, and on both ends of that wooden rod two extra wooden pieces were attached. This author told them that one extra wooden piece from one side must be removed, which was done and such wooden rod, the gravitational dipolar rod clearly asymmetrical as defined above in this paper, was attached to be horizontal to the vertical axle of the apparatus of Mr. Kovacevic. After a few oscillations that wooden rod assumed the magnetic NS direction in the horizontal plane as shown by a nearby magnetic compass with the attached wooden piece pointing towards the magnetic South. This author fully expected that result in view of many experiments which this author performed in his apartment since 2002. This author never saw that apparatus or Mr. Kovacevic again, but by telephone this author suggested various checks, which Mr. Kovacevic preformed with the expected positive results as he told this author by telephone. This author considers that the apparatus of Mr. Kovacevic is very useful for the public demonstrations and also for the measurements as described above in this paper and elsewhere by this author, although the results obtained by that apparatus may not be fully convincing to some skeptical scientists without the basic experiments of this author as described above in this paper. Mr. Kovacevic has presented his apparatus on the Internet. He sent this author via e-mail two photographs of that apparatus and the schematic diagram which are attached here with this paper for anybody who is interested to make a replica, which can be done by anybody competent in electronics and mechanics.

The explanation of the obvious mechanical torque experimentally detected by the above described experiments at two locations in Belgrade about 6.4 km air distance apart acting upon the pivoted dipolar non-ferromagnetic mass test needle-rod, i.e., the presence of the obvious horizontal component of the force, i.e. torque acting upon that pivoted test mass object, cannot be found in the presently accepted classical Newton's theory of gravity, i.e. gravitation. The International Gravity Formula defines only the vertical component of the force acting upon a test mass. However, this author has discovered a centuries long mathematical error in the very foundation of physics, whose correction can resolve this problem strictly within the classical Newtonian mechanics. Namely, the coordinate origin of the presently used geophysical coordinate system is defined to coincide with the center of mass of the Earth. But if such a coordinate system is used in the development of the

gravitational potential of the Earth in the Taylor series at the coordinate origin, then by definition the second dipolar term in that Taylor series is zero. That is a very serious problem and the serious violation of the theory of approximation. Unless further terms in the Taylor series are used, the approximation is poor and inadequate when the variation of the gravitational field around one point is considered, since the dipolar term was dropped without any justification. But that problem is readily resolved if the coordinate origin of the presently used geophysical coordinate system is moved from the center of mass of the Earth to the center of self-gravity of the Earth. The center of self-gravity of a mass distribution is defined as the point normally within that mass distribution at which the gravitational field of that mass distribution is zero. The center of mass of a mass distribution is the point with respect to which the mass moment of that mass distribution is zero. These two points are unique and quite different, and invariant if the mass distribution is invariant. These two points coincide only in the case of a mass distribution which is absolutely symmetrical, and such a celestial body is never found in nature. The lack of distinction of these two points as quite different is the perennial, centuries long error in the very foundation of physics which propagates through physics up to now. These two points are misunderstood, often considered as one point in the literature so far, which is totally wrong. In fact the center of mass of a mass distribution is strictly only a mathematically defined point, which can never be exactly determined or measured experimentally, not even in principle, except approximately, since for its exact experimental determination, a strictly uniform, constant gravitational field is necessary, which extends infinitely through the space, and such a gravitational field does not exist in nature. So the center of mass is strictly a mathematical point. On the other hand, the center of self-gravity (or gravitation) of a mass distribution can be always exactly determined experimentally, at least in principle, and it is the point with respect to which all gravitational measurements should and must be referred.

Using the center of self-gravity of the Earth as the coordinate origin of the geophysical coordinate system the approximate Earth's gravity formula must contain not only the monopolar term and the centrifugal term, but also the additional dipolar term, which was erroneously dropped so far in the literature due to erroneous choice of the geophysical coordinate system so far. In that dipolar term, the intrinsic mass dipolar moment of the Earth is calculated with respect to the center of self-gravity of the Earth. With such a corrected Earth's gravity formula, it is easy to show by applying strictly the rules and the laws of the classical Newtonian mechanics, that the pivoted dipolar mass test object, which is non-.ferromagnetic, is subjected to the torque which is the vector product of the intrinsic mass dipolar moment of the Earth and the intrinsic mass dipolar moment of the pivoted dipolar

mass test object, with, of course, the appropriate factor. Considering further all experimentally measured results and facts from geomagnetism, it is concluded that the Earth's large scale magnetic field, and the large scale magnetic field of any celestial body is a manifestation of gravitation. It appears that the dipolar intrinsic mass moment of a celestial body is indeed the magnetic moment of that body with the appropriate factor. All mathematical details and reference to the numerous experimental facts concerning this problem can be found in the paper by this author "MAGNETISM AS MANIFESTATION OF GRAVITATION" on the Internet Site of The Journal of Theoretics

http://www.journaloftheoretics.com/Links/Papers/JD.pdf

Addendum

The question may be raised whether diamagnetism of the gravitational dipolar needle in the above described experiment might be responsible for the observed torque and the equilibrium position of the needle. To analyze that possibility, consider the torque upon a body pivoted or suspended at the local coordinate origin with $\vec{M}$ its magnetization density, i.e., density of the magnetic dipole moments per unit of volume, in the magnetic field $\vec{B}$

$$\vec{T} = \int \left\{ \vec{M} \times \vec{B} + \vec{r} \times \left(\vec{M} \cdot \nabla \right) \vec{B} \right\} dV \ ,$$

which formula can be found in any comprehensive textbook on electricity and magnetism. For the bronze (non-magnetizable) needle in the above experiment $\vec{M} = \chi_m \vec{B} / \mu_0$, where χ_m is its magnetic susceptibility, negative in this case, and $\vec{B}$ is the ever and everywhere present Earth's magnetic field. The first vector product in the above integral is zero by definition in this case, while the second vector product term is estimated to be maximum of the order of 10^{-21} Nm using $\left|\chi_m\right| = 10^{-3}$, $\left|\vec{B}\right| = 5 \cdot 10^{-5} T$ (0.5 Gauss), Earth's radius $6.37 \cdot 10^{6} m$, and the actual specified dimensions of the needle in this experiment. However, the torque on this needle due to the gravitational effect as analyzed in the paper "MAGNETISM AS MANIFESTATION OF GRAVITATION" is estimated to be of the order of 10^{-10} Nm for the needle in this experiment (cf. the estimate in the mentioned paper). It must be mentioned that no difference in the movement of the needle and its equilibrium position was observed by this author, whether the needle was made of diamagnetic (bronze) or paramagnetic (aluminum) material, but the friction appears to be larger in the case of aluminum. The conclusion from the theoretical estimates and the experiments is that diamagnetism and paramagnetism cannot explain the above described experimental results.

Due to the recent substantial improvement of the technique of making the gravitational dipolar needles of any non-magnetizable, non-ferromagnetic material for the rather quick placement on the pivots, these experiments can be readily and rather quickly demonstrated in any tightly closed room in which draft and air movement because of the possible temperature gradients are strictly eliminated.

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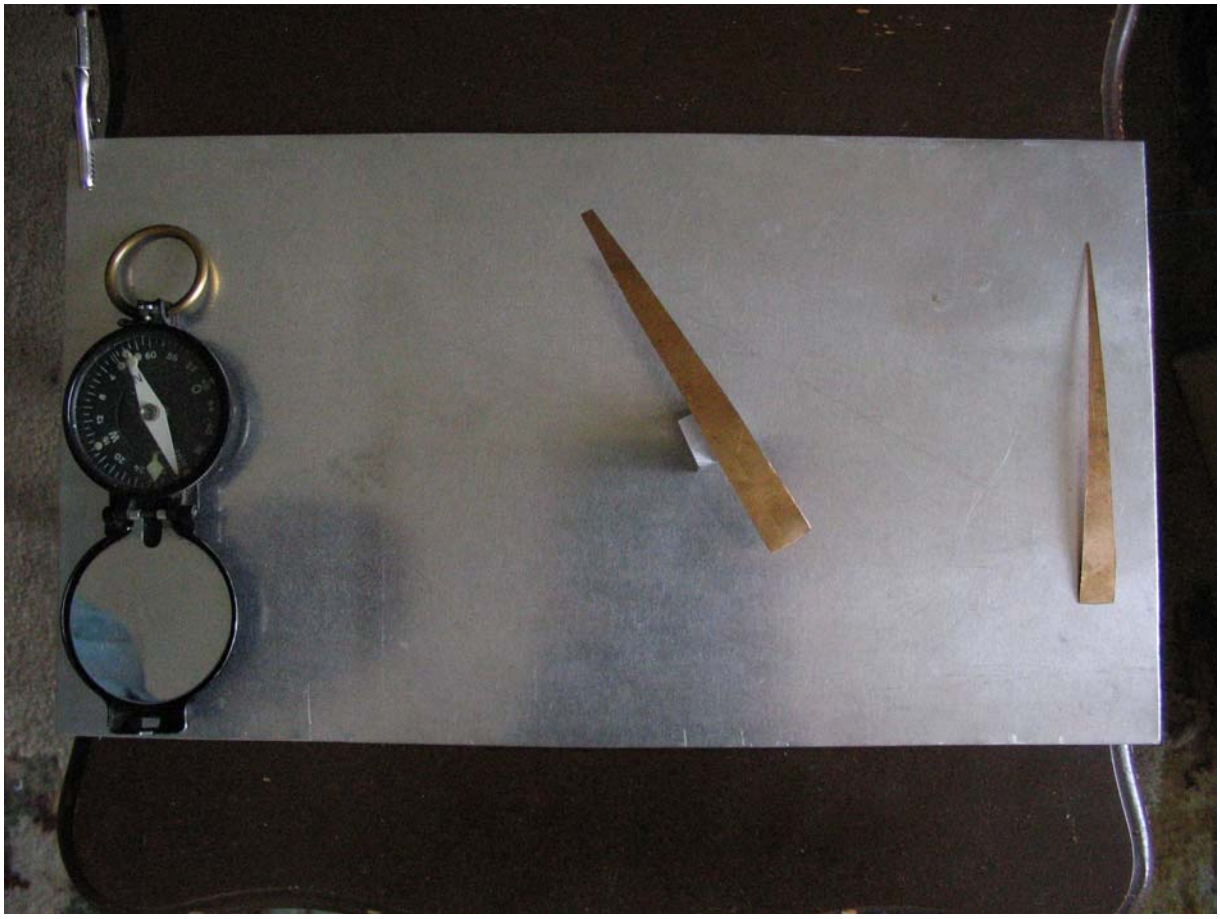
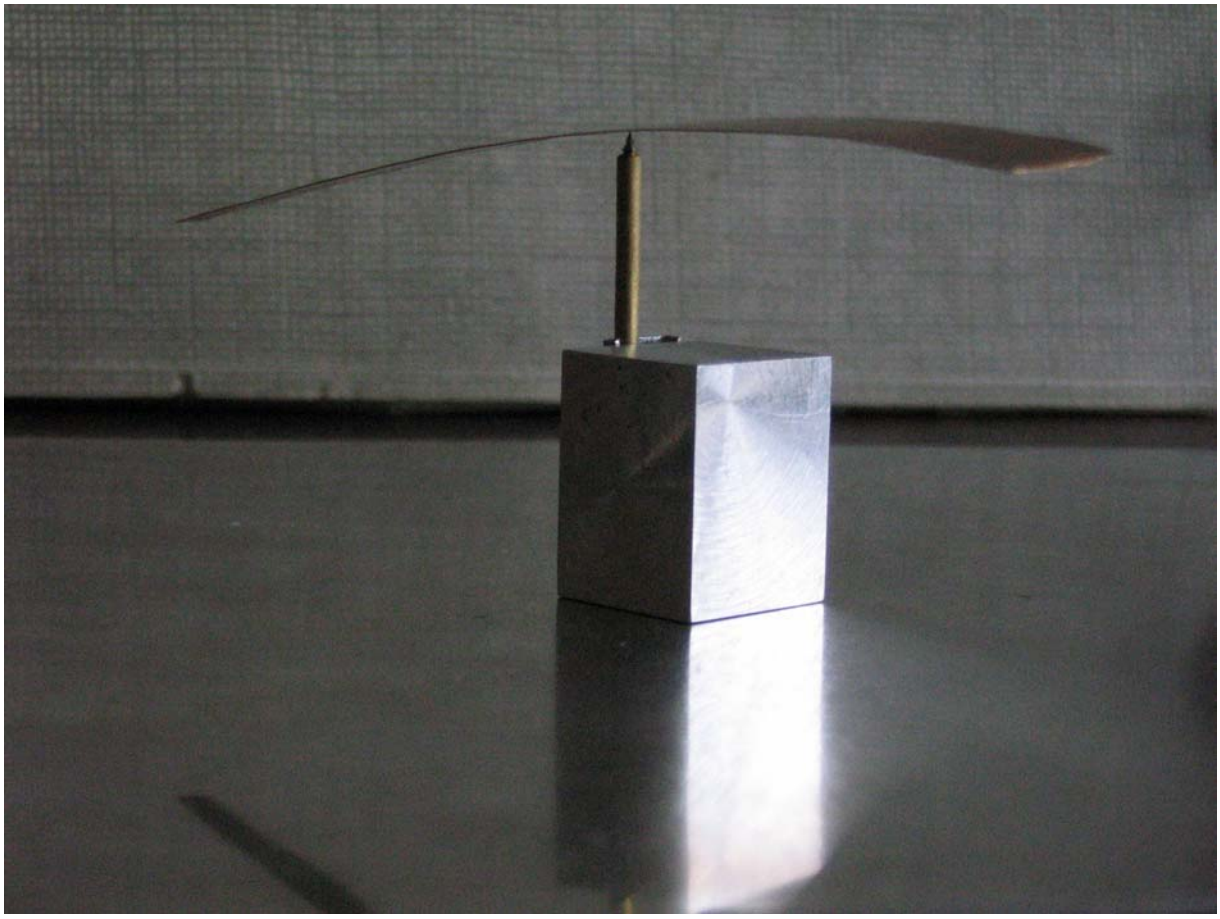
Photographs





Photographs of the apparatus of Mr. Kovacevic