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Consideration of the Daily Variation of Gravity on the Manifestation of Gravitational Shielding

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Abstract

The result of mathematical and physical analysis of the daily change in gravity is presented. The subject of consideration was the manifestation of semi-daily factors in diurnal variations of gravity. The assumption is investigated, according to which the cause of the half-day factors is the gravitational shielding of the planet Earth. Gravitational shielding is considered as a function of the size and thickness of celestial bodies and growing with distance from their poles. It is concluded that the planet Earth has the property of partial gravitational shielding, and the Moon does not have enough thickness to exhibit a tangible gravitational shielding. The obtained mathematical results correspond to the existing experimental data. It is suggested that gravitational shielding is the cause of the precession of the perihelion of Mercury and the peculiarities of the manifestation of tidal processes. It is assumed that gravitational shielding is one of the main reasons for the presence of hidden substances in the Universe. It is concluded that the physical picture with mutual shielding of interaction elements corresponds to the classical ideas of Fatio and Lesage. This approach is proposed as an alternative point of view to the existing theory on the description of tidal processes. It is shown that the existing basic approach to the description of tidal forces is unsatisfactory: the factors underlying the existing approaches have values 10 times less than those observed and cannot be considered as the reason for the manifestation of half-day manifestations in the daily change in gravity. The work is a continuation of the implementation by the author of P. Dirac's ideas about accounting for the size of microparticles in physical theory.

Keywords

Gravitational Shielding, Diurnal Variations of Gravity, Solar Eclipse, Fatio-Lesage Theory, Gravity Anomalies, Universal Gravitational Constant, Semidiurnal Changes, Precession of Mercury's Perihelion, Hidden Mass

1. Introduction

The question of the gravitational interaction has occupied and continues to occupy a fundamental position in the physical and philosophical concepts throughout the conduct of scientific research. An integral part of the question of gravitational interaction is the question of gravitational shielding. The study of this question also has a century-old history (Majorana, 1920; Majorana, 1930; Russell, 1921), and it continues at the present stage due to its special significance and relevance, and the lack of a corresponding satisfactory physical picture, although it is believed that convincing results about the presence of gravitational shielding could not be established. In terms of significance, the results of the study on gravitational shielding are the basis of the foundations of the philosophy of physics, primarily organically related to the question of the ether. The existence of the ether did not cause doubt in the intuitive view of the classics of physical science, who interpreted many physical phenomena in the assumption of its existence.

According to the study of gravitational shielding, there are quite a lot of works (Edwards, 2002; Pratt, 2001) carried out within 100 years after the work of Q. Majorana by different researchers. However, the results obtained do not allow us to evaluate them in an unambiguous way, they do not meet the requirements of reproducibility, do not lead to general and unambiguous conclusions. According to the results obtained, many types of anomalies were observed in the mutual screening of celestial bodies. Anomalies were observed in the movements of artificial Earth satellites (Van Flandern, 1996), in perturbations in the plane of oscillations of pendulums (Alley effect) (Allais, 1959), including deviations in the plane and in the period of oscillations of the Foucault pendulum (Jeverdan, Rusu & Antonescu, 1999). Anomalies are also revealed during various types of syzygies of the planets of the solar system (Olenici & Pugach, 2012; Olenici, Pugach, Cosovanu, Lesanu, Deloly, Vorobyov, Delets & Olenici-Craciunescu, 2014). In some cases, observations were accompanied by incomprehensible manifestations, anomalies were observed during a solar eclipse not in places where there were eclipses, but far from this place (Vezzoli, 2004), instead of the expected increase in the observed parameter, on the contrary, its decrease was observed (Olenici & Pugach, 2012). In the interpretation of the manifestation of anomalies, versions are also put forward, according to which the observed anomalies are accepted as a consequence of factors unrelated to screening. Such factors include atmospheric processes during experiments, the influence of electrical factors, experimental errors, etc. According to some researchers, these interpretations look unconvincing (Duif Chris, 2004, 2011).

The issues of gravitational shielding are also considered within the framework of modern approaches. In Wu (2003) based on the gauge theory, the possibility of the existence of gravitational shielding was shown. It was concluded in Portilla (2021) that dark matter and dark energy can be explained as a gravitational effect within the standard general theory of relativity. In Sizov (2019) it was con-

cluded that the effect of gravitational shielding is directly related to such a well-known concept as the nuclear mass defect.

On the basis of the classical approach, the mass defect, as a result of the mutual spatial overlap of nucleons in the atomic nucleus, was considered in Radzhabov (2022). In this work, an analytical expression for the binding energy of nucleons was obtained.

In short, there are many uncertainties with respect to gravitational shielding that require careful further study.

The lack of satisfactory results in the development of physical theory forces researchers to look for other approaches and express new ideas. Regarding the further development of the physical theory, P. Dirac presented his own ideas. In his review article "The Evolution of the Physicist's Picture of Nature" Dirac set forth a number of opinions in which he noted certain circumstances, the consideration of which would contribute to the further development of physical theory (Dirac, 1963). These circumstances in his opinion are as follows:

- A return to the analogue of the classical ether;
- The taking into account of actual sizes of microparticles (electrons);
- The use of Faraday force lines with a finite number of them.

The author of this paper implemented Dirac's ideas in Radzhabov (2021), where new results were obtained and new ideas were proposed. This work is also a continuation of the implementation of P. Dirac's ideas in terms of taking into account the sizes of interacting elements. This consideration gives grounds to consider the interaction as a result of mutual spatial shielding, in particular, to expect the presence of gravitational shielding. Thus, the consideration of the issue takes place within the framework of classical physics. This approach is proposed in the context of an alternative to the currently existing approaches and the validity of its application is discussed in the "Discussion" section.

2. Method and Calculations

The rationale for the applied approach in this work is two factors:

- The possible existence of gravitational shielding, as indicated by the results of the above works regarding the manifestation of anomalies;
- The hypothesis of the manifestation of gravitational shielding depending on the thickness of massive objects.

The conclusions of numerous works on the manifestation of anomalies in the mutual shielding of celestial bodies give reason to consider the planet Earth as an object with the property of gravitational shielding. Considering the diurnal variations of the Earth's gravity in this regard can answer the question—can the Earth shield physical bodies from gravitational influence of luminaries—Moon and Sun? Consideration of gravitational shielding in this case differs from its consideration during a solar eclipse. In this case, the shielding object is the planet Earth, which has a larger size and a larger mass than the Moon, i.e. the shielding effect of the Earth, if any, is significantly greater than such an effect from

the Moon. On the other hand, the test body is located directly on the surface of the shielding object—the Earth, which makes the manifestation of the effect, if there is one, more noticeable. In the presence of gravitational shielding, the daily rotation of the Earth should lead to corresponding changes in the magnitude of gravity due to the fact that the body can be both in front of the shielding object—the Earth, and behind it, in relation to the luminaries. To analyze the diurnal variations of gravity, data from experiments given in (Antonov, Antonova & Volkova, 2010; Gusev, 2006; Proshkina, Valitov, Kulinich & Kolpashchikova, 2015; Antonov & Vorontsova, 2011; Melchior, 1966) are used.

As is known, the diurnal variations of gravity on the Earth's surface are determined solely by the effects of the luminaries and the influence of third bodies cannot be attributed to them, since the influence of other planets or other space massive objects on terrestrial processes is insignificant. The effects of the luminaries are strictly periodic in time and all diurnal variations of gravity should be considered as their combinations. The influence of the luminaries on terrestrial processes can be divided into direct and indirect. The direct impact of the luminaries can be described by a periodic function, which has one maximum and one minimum during the day. Other manifestations can be attributed to their indirect effects. Semi-daily manifestations in the diurnal variation of gravity can be attributed to the indirect effects of the luminaries.

Let us consider a qualitative picture of the daily change in gravity under the assumption of the existence of gravitational shielding in the interaction of two massive bodies. The study of the possibility of the existence of gravitational shielding for massive bodies implies taking into account their gravitational structure.

When considering the mutual spatial shielding, the main parameters are the dimensions of the elements involved in the shielding. As you know, gravitational shielding, if it takes place in nature, is the result of mutual shielding of mass-forming elements, which are nucleons and systems consisting of them—atomic nucleus. Mutual shielding of nucleons for small amounts of them is significant, which takes place in the atomic nucleus, whereas mutual shielding of atomic nuclei can be expected at very large thicknesses of ordinary bodies. In this case, the screening parameter—as the ratio of the size of the shielding elements to the distance between them—is very small. In fact, this ratio, defined as the ratio of the size of the atomic nucleus to the size of the atom, is on the order of 10^{-4}, which makes ordinary substances quite loose in terms of mutual shielding. This representation is illustrative and leads to the conclusion that with insufficient thicknesses of ordinary substances gravitational shielding cannot take place. The phenomenon of gravitational shielding should be sought for massive celestial bodies.

Thus, the gravitational structure should be understood as the presence of a dependence of gravitational shielding on the thickness of massive bodies. In the case of massive spherical body, the effect should manifest and increase as it moves away from the poles and reach a maximum value near the equator or

when a certain critical thickness is reached.

The gravitational structure of a massive body can be represented in accordance with Figure 1, where the dark area indicates the presence and degree of shielding when the second massive body is located in the horizontal direction on the right.

Let the trial body be located on the surface of a massive body—the Earth, which is located in the gravitational field of the luminary, located in the horizontal direction (Figure 1). With the daily rotation of the Earth, the test body can be in different positions relative to the luminary. In position 1, gravity takes a minimum value $g_{\min 1} = g - \Delta g$ due to the gravitational influence of the luminary on the body from the opposite side. In positions 3 and 7 in the radial direction, there is no influence of the luminary on the body, and the vertical component of gravity is equal to g. In positions 4 and 6, the body experiences additional force in the direction of the Earth due to the influence of the luminary $g_{\max} = g + \Delta g \cos\alpha$, where α is the angle between the direction of the impact force of the luminary and its radial component. At position 5, the gravity curve drops to $g_{\min 2} = g + \Delta g - \Delta g_{sh}$, where Δg_{sh} is the magnitude of the decrease in gravity due to the Earth shielding the force of the impact of the luminary. In the presence of shielding, the daily change in gravity has the following qualitative character (Figure 2): in between positions 1 - 4, there is an increase in gravity from $g_{\min 1}$ to $g_{\max}$; in between positions 4 - 5, it decreases to the value of $g_{\min 2}$; in between positions 5 - 6, it returns to $g_{\max}$; in between positions 6 - 1, it decreases to the value of $g_{\min 1}$.

Thus, a qualitative examination of the diurnal variation of gravity shows that in the presence of gravitational shielding, semi-diurnal effects can manifest themselves—the manifestation of two minima and two maxima in the behavior of the diurnal variation.

For a quantitative assessment, let us turn to the mathematical descriptions of the semi-daily factor of the daily variation of gravity. In this aspect the periodic effects of the Moon and the Sun should be described by strict periodic functions.

The variation of gravity from the influence of one luminary in the presence of a shielding factor can be written by the function

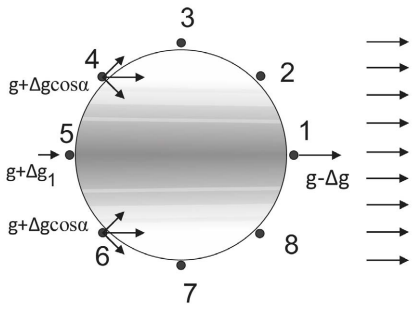

Figure 1. Daily change of vertical gravity depending on the gravitational structure of a massive body in the gravitational field of massive body located in the horizontal direction on the right.

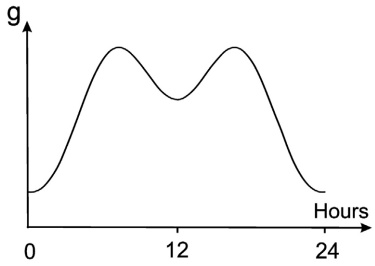

Figure 2. Possible manifestation of half-day factors in the daily change in gravity during the gravitational shielding by the Earth the influence of the luminary.

$$\Delta g = a\sin\omega t + a\sin\left(2\omega t + \psi\right). \quad (1)$$

For value of $\psi = 1.57$ this function gives a graph in **Figure 3**, where semi-daily changes are manifested.

The daily variation of gravity from the direct influence of two luminaries—the Moon and the Sun can be written, respectively, in the form

$$\Delta g_M = a_M \sin\omega_M t$$

$$\Delta g_S = a_S \sin\omega_S t$$

where a_M, a_S are the amplitude constants, and ω_M, ω_S are the phase paramètres of the influence of the Moon and the Sun, respectively.

In the absence of the influence of third factors, the resulting function has the form:

$$\Delta g_d = a_M \sin\omega_M t + a_S \sin\omega_S t, \quad (1)$$

the schedule of which is shown in **Figure 4**.

The contribution of the shielding factor can be written as

$$\Delta g_{sh} = a_{Msh}\sin\left(2\omega_M t + \psi_M\right) + a_{Ssh}\sin\left(2\omega_S t + \psi_S\right) \quad (2)$$

where a_{Msh} and a_{Ssh} —are the amplitude constants.

Adding (1) and (2) gives the resulting function:

$$\Delta g = a_M \sin\omega_M t + a_S \sin\omega_S t + a_{Msh}\sin\left(2\omega_M t + \psi_M\right) + a_{Ssh}\sin\left(2\omega_S t + \psi_S\right) \quad (3)$$

Combinations of the values of the constants included in (3) allow us to obtain different graphs of the behavior of the resulting function, a common feature of which will be the manifestations of two maxima and two minima per day—the presence of semidiurnal changes.

It is possible to plot the change in the daily variation of gravity by substituting the values of constants and parameters in (3). We take the ratio of phase parameters as $\omega_S = 0.97\omega_M$, which follows from the difference in the duration of the lunar and solar days in the year.

The ratio of the amplitudes a_M and a_S is taken as $a_M = 2a_S$, since the daily influence of the Moon is twice the daily influence of the Sun. On this basis, we write: $a_{Msh} = 2a_{Ssh}$. The ratio between the amplitudes a and c, b and d can be taken from the difference between the calculated values of the amplitudes and the values determined experimentally. According to Yuzefovich & Ogorodova

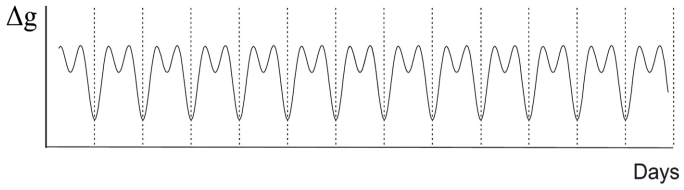

Figure 3. The manifestation of semi-daily factors in the daily variation of gravity according to (1) when exposed to one luminary.

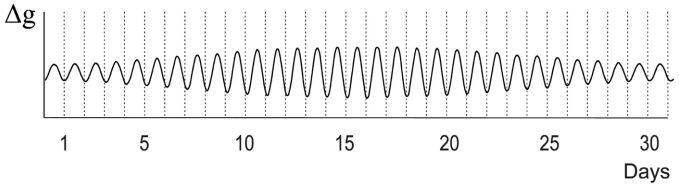

Figure 4. Calculation of gravity variation under the direct influence of the Moon and the Sun for one month.

(1980), the observed value in the gravity variation is 0.68 of the calculated value. When considering gravitational shielding as the cause of the effect, it means that there is a partial gravitational shielding from the Earth. For mathematical calculations, this means that $c < a$ and $d < b$.

Comparisons with experimental data show that it is possible to write $c = 0.8a$ and $d = 0.8b$. And finally, for values $a_M = 0.1\times10^{-5}\frac{m}{c^2}$, $\omega_M = 6.06$ expression (3) is written as:

$$\begin{aligned}\Delta g = {} & 0.1\left(\sin 5.88x + 0.8\sin\left(11.76x + 1.57\right)\right) \\ & + 0.2\left(\sin 6.06x + 0.8\sin\left(12.12x + 1.57\right)\right)\end{aligned} \tag{4}$$

The calculated curve of this function for 35 days is shown in **Figure 5** (curve 1).

The calculated result obtained corresponds to the ideal case of a diurnal change in gravity. The real picture requires appropriate amendments. In this regard, corrections will need to be made to the phase parameters ω and ψ, which reflect the transition of the body to the area of shielding by the Earth, which is affected by its thickness. An adjustment should also be made for the values of amplitudes that depend on the location of the body in latitude.

The calculated curve for 35 days (**Figure 5**, curve 1) contains areas that are in satisfactory agreement with the results of experimental observation. The curves of experimental observation of the daily variation of gravity from the works shown in **Figure 5** (curves 2 - 6) are in satisfactory agreement with the sections of the calculated curve.

The values of the parameters *a*, *b*, *c*, *d* vary depending on the latitude of the area, the establishment of which requires a separate study. The view of the calculation chart changes in a wide range from a combination of these parameters.

The manifestation of the effect also depends on the position of the body on the Earth's surface: the farther the body is from the equator, the weaker the

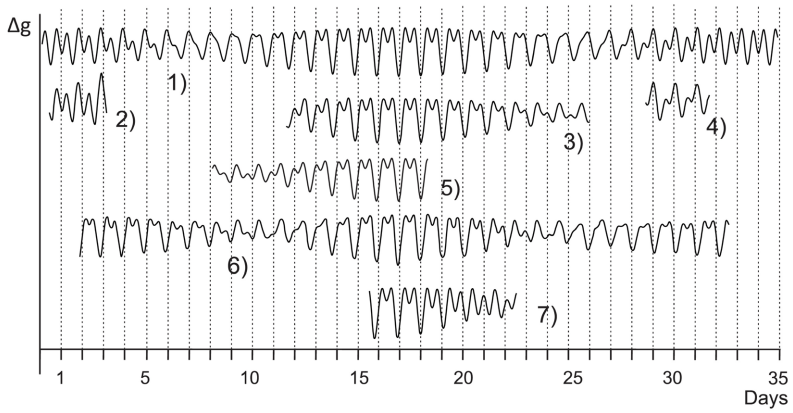

Figure 5. Calculated (curve 1) and experimental (curves 2 - 7) graphs of the daily variation of gravity. Experimental data: 2) (Gusev, 2006); 3) (Antonov, 2019); 4) (Antonov, Antonova, & Volkova, 2010), 5) (Proshkina, Valitov, Kulinich, & Kolpashchikova, 2015), 6) (Melchior, 1966); 7) (Antonov & Vorontsova, 2011).

semi-daily variations of gravity appear. Experimental data confirm the existence of a dependence of gravity on the thickness of a massive body. Thus, according to the data (Antonov, Antonova & Volkova, 2010; Gusev, 2006) (**Figure 6**), with the distance from the equator of the Earth, there is a weakening of semi-daily factors. In general, a more precise quantitative consideration requires taking into account partial screening and determining the nature of the effect when the test body exits the screening area and enters it.

3. Gravitational Shielding in Physical Phenomena

The precession of the perihelion of Mercury

Within the solar system, during their movement, planets regularly enter the area of mutual shadow. Due to the presence of gravitational shielding, the ratio of forces acting on them changes for a while, which manifests itself as the influence of the third body. This especially affects the movement of less massive celestial bodies. It was as an influence of the hypothetical planet "Volcano" on Mercury that they wanted to interpret the phenomenon of precession of its perihelion (Roseveare, 1982).

The smallest planes in the solar system—Mercury with its special position is more sensitive to the shielding effect. When large planets screen each other, the resulting force acting on it from the side of the planets decreases, the total resultant force becomes larger from the side of the Sun. Moreover, due to the large size of the Sun, Mercury's residence time in the shadow area becomes longer, which makes its precession more noticeable. The quantitative result requires taking into account the factor of mutual shielding of other planets in the direction of Mercury, the time of its stay in the shadow field of the planets.

Tides

Regarding tidal phenomena, the authors usually adhere to an interpretation regarding such a feature as the formation of two humps on opposite sides of the

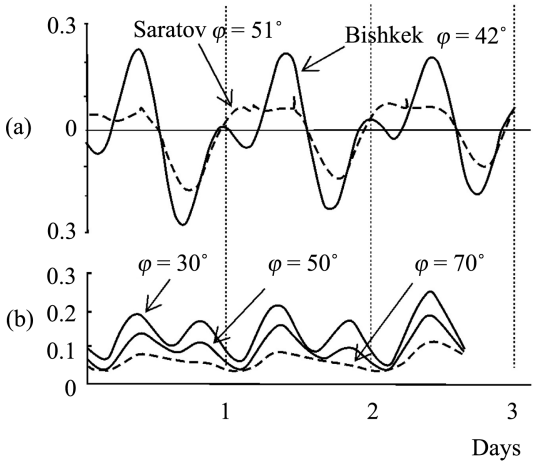

Figure 6. Observation data of diurnal variation of gravity for different latitudes according to (Antonov, Antonova & Volkova, 2010) (a) and (Gusev, 2006) (b).

planet and relatively two-time observation of tides during the day. Although the answers do not look very convincing, we do not put them to the fore. First, we focus on those circumstances that are not discussed at all in the consideration of tides. They are as follows:

- A strong increase in the water level, up to ten meters, is observed in rivers, not in oceans, where the increase in the water level is only tens of centimeters.
- A strong manifestation of tides is observed only in relation to rivers, the flow of which occurs along the longitude of the Globe: Amazon River—height up to 4 meters, Fuchunjiang River (Hangzhou, China)—the highest tidal boron in the world, height up to 9 meters, Poultry Tree River (Fandy Bay, Canada)—height reached 2 meters, Cook Bay, one of the sleeves (Alaska)—height up to 2 meters.

Based on the data obtained, it is possible to offer a satisfactory explanation for the appearance of tidal processes. Let's assume that the Earth is a celestial body with a shielding thickness. The spherical shape of massive bodies suggests that there are parts for them that may be in the area of greater or lesser shielding. For spherical bodies, the peripheral regions will always be in the area of less or zero shielding. Due to the presence of the shielding thickness of the planet Earth, the influence of the Moon is more pronounced only in the peripheral zones and waters. In this case, we can say that the tides are more peripheral effects than volumetric (**Figure 7**).

The peripheral influence of the Moon can also explain the large difference in water levels in rivers and oceans. It should be noted that a strong rise in the water level is observed for rivers and bays with a length in longitude. For this reason, their waters can remain longer under the influence of the Moon, which cannot be said about the water of rivers flowing in the azimuthal direction. The reason for the slight increase in the water level in the oceans is that the ocean waters under the influence of the Moon have connections with the part of the

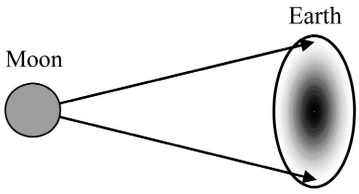

Figure 7. Diagram of the gravitational effect of the Moon on the Earth's zones in the form of a cross-section of the Earth. The degree of gravitational shielding from the Earth is expressed by the degree of darkness in the figure.

ocean that is not in the field of influence of the Moon due to the presence of shielding. The picture is similar to communicating vessels, where communication with other vessels does not allow the water of one vessel to rise to such a level if there was no message.

It can be explained why a strong increase in water is observed for rivers that flow in longitude. Unlike the waters of the oceans, river waters do not have a connection where accumulating water could go, since during the impact of the Moon, the return path to the ocean is closed to water, since the impact is directional along the course.

And finally, one can explain the fact why tides appear twice a day. A simple explanation is that any peripheral point with a daily rotation of the Earth will be twice in the field of influence of the Moon.

4. Discussion

The following arguments served as the basis for the proposal of this approach: 1) conclusions of a number of works on the manifestation of anomalies during eclipses; 2) the dubious basis of the existing description of tidal forces; 3) compliance with classical ideas and expectations.

In scientific sources, semi-daily manifestations of gravity are associated with natural deformations of the Earth—Earth tides (Melchior, 1966). It is believed that under the action of tidal forces, the earth's surface moves towards the source of the force and the earth's surface moves away from the center of the Earth. Along with the Earth's surface, the measuring device is also moving away from the center of the Earth, which records the weakening of gravity at this moment.

This statement does not look convincing enough. It has been established that the displacement of the earth's surface during tidal processes is tens of centimeters (Orlov, 1915). The variation of gravity in this case is calculated by the formula:

$$\Delta g = GM_E\left(\frac{1}{R^2}-\frac{1}{(R+h)^2}\right) \tag{5}$$

where G is the universal gravitational constant, M_E is the mass of the Earth, R is the radius of the Earth, h is the amount of displacement of the Earth's surface at tides. Calculation by (5) shows that the expected effect in this case is about 10^{-6} m/s^2, which is an order of magnitude lower than the observed effect (**Figure 8**).

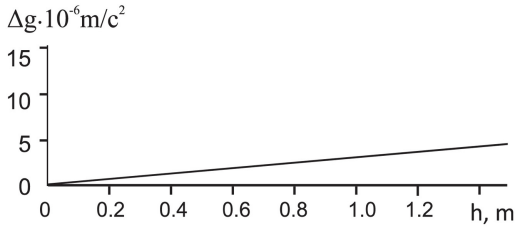

Figure 8. Variation of gravity in displacement the test body to a height of tens of centimeters.

The picture of the mechanism is based on the hypothesis that the luminaries act differently on different points of the Earth, which, as it were, leads to the emergence of additional force (**Figure 9**). This is just a hypothesis, and the mathematical description of this picture also does not look convincing. Actually, the variation of gravity from the acting forces from the side of the luminary to different points of the Earth is described by the expression [24]

$$\Delta g = GM\left(\frac{1}{r^2}\cos\theta - \frac{1}{r'^2}\cos\theta'\right) \tag{6}$$

where M is the mass of the Earth, r is the distance from the body on the Earth's surface to the luminary, r' is the distance from the center of the Earth to the luminary, θ is the angle between the direction r and the line from the center of the Earth to the zenith point, θ' is the angle between the direction r' and the line from the center of the Earth to the zenith point. Δg in (6) reaches its maximum value when the luminary is at the zenith. In this case, $r' = r + R$ and the expression for the change in gravity is written as:

$$\Delta g = GM\left(\frac{1}{r^2} - \frac{1}{(r+R)^2}\right) \tag{7}$$

where M is the mass of the luminary, R is the radius of the Earth, r is the distance from the luminary to the body on the Earth's surface. The calculation according to (7) for the variation of gravity from the influence of the Moon also gives a value of the order of 10^{-6} m/s^2 (**Figure 10**).

Studies, mainly of a theoretical nature, do not consider gravitational shielding as a possible cause of the appearance of indirect factors, although experimental data indicate that the observed anomalies are associated with its existence.

Thus, it can be concluded that the currently existing approach for describing the variation of gravity is not physically justified. As for the currently existing ideas regarding the issues under consideration, they do not allow us to fully and satisfactorily describe all the phenomena associated with tidal processes. So, an attempt to create a mathematical description of tidal phenomena in the ocean on their basis led researchers to great disappointment. One of the major researchers of dynamic oceanology, J. Proudman, expressed his opinion on this issue as follows: "I and my disciples spent 30 years solving the problem of the theoretical description of the simplest tides in the sea—the tides of the Pacific Ocean. I must say that our efforts have been fruitless. Modern means of mathematical analysis

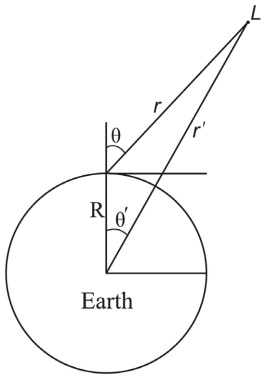

Figure 9. A diagram to the existing theory for describing tidal forces.

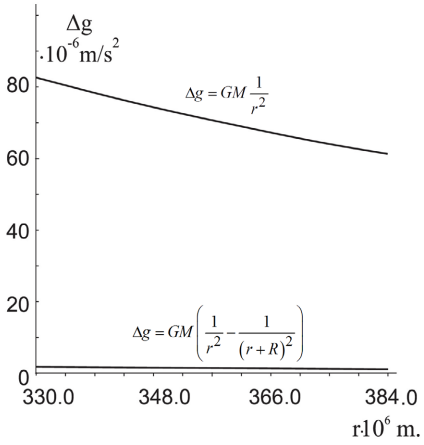

Figure 10. Variation of vertical gravity from the direct influence of the Moon (curve above) and from the difference of its influence on different points of the Earth (curve below).

have proved insufficient to describe this simplest tide. Therefore, the old method of empirical study of actual phenomena in the ocean remains the main one for now" (Maksimov, 1970: p. 80). A similar opinion was expressed by another researcher, Maximov I.V. "… we have to admit that the question of the mechanism of the occurrence of tidal phenomena in the Earth's ocean has been clarified so far, even in the case of semi-daily and diurnal tides, only in the form of the most general hypothesis and remains, in essence, unclear…" (Maksimov, 1970: p. 267).

In this paper, consideration is carried out and results are obtained based on the assumption that gravitational shielding of physical bodies takes place in nature, and it manifests itself when the shielding bodies reach the required thickness.

The peculiarities of the manifestation of tidal processes indicate that bodies on the Earth's surface periodically appear both in the field of greater influence of the luminary—when they are located in relation to the luminary in the peripheral part of the Earth, and away from its much influence, when the Earth shields them from the luminary as much as possible. The Earth can be considered as a

body consisting of two parts: with greater gravitational permeability and with weak gravitational permeability. The gravitationally weakly permeable part can be represented as a single solid body having a maximum thickness on the side of the luminary.

Another question about tidal processes is the factor of their time lag. It is doubtful that the delay time is 6 hours. In fact, there is no lag, if we take into account the fact that the impact of the luminary takes place for objects peripheral to the luminaries on Earth, mainly for the waters of the oceans, seas and rivers.

One of the serious issues in the description of tidal processes is the emergence of a second hump in the waters of the ocean. Firstly, the rise of water at high tides cannot be called a hump, since there is a rise of sea waters by only a few tens of centimeters, not by kilometers, to be called a hump in relation to the size of the Earth. This fact itself denies the presence of the volumetric influence of tidal forces. Actually, the rise of the water level is due to the confluence of peripheral waters, which are exposed to the luminaries, in the center. Due to the outflow of water from the peripheral areas, the water level in front and behind becomes higher.

On the variability of the gravitational constant

The presence of gravitational shielding suggests a different view of the universal gravitational constant G. Influence of shielding on the parameters characterizing background space influence is other considerable consequence in the presence of gravitational shielding. In this plan the shielding has to change locally value of G. Actually, in case of gravitational shielding G can't remain such what it is at exposure when the body has no other bodies in the environment which can shield him. It is the reason that G behaves more floatingly, than other physical constants. About variability of value G it is reported in works (Kiernan, 1995; Spolter, 2005).

On the negative results of the study of gravitational shielding during a solar eclipse

A lot of works is devoted to the study of gravitational shielding during a solar eclipse. Although there are observations of various kinds of anomalies during a solar eclipse, however, the fact of the existence of gravitational shielding has not been established (Arnautov, Kalish, Stus, Smirnov, Bunin, & Nosov, 2009; Radziyevskiy, 2004; Savrov, 2004; Sarycheva, Timofeyev, & Khomutov, 2004; Arnautov, 2005; Arnautov, Kalish, Smirnov, Stus, & Tarasyuk, 1994). The authors of (Wang, Yang, Wu, Guo, Liu, & Hua, 2000; Yang & Wang, 2002; Zhou, 1999) note that although there were no noticeable changes in the totality during the solar eclipse, a fairly significant decrease in vertical gravity was observed during the first and last contacts.

The reason may be that the Moon does not have the necessary thickness for the manifestation of gravitational shielding to be noticeable.

The fundamental importance of this work

The presence of mutual shielding is the main attribute of the classical Fatio-Lesage representation, where the mechanism of gravitational interaction is

considered as a result of the pressure of streams of the smallest ether particles on physical bodies. In other words, the proposed point of view claims to ensure the clarity of the physical picture and the fulfillment of the principle of causality. So, if the physical cause of the precession of the perihelion of Mercury is not considered within the framework of GRT, the proposed work indicates that this is due to the mutual shielding of the planets of the Solar system. The presence of gravitational shielding for the planets of the solar system leads to a new look at the truth of knowledge about the amount of matter and density of planets. We will address these issues in our future work.

Thus, we can give a list of factors indicating that there is a gravitational shielding of physical objects in nature:

- Intuitive (philosophical) expectation of the classics of physical science;
- Kinetic theory of Fatio-Lesage;
- Precession of the perihelion of Mercury;
- Manifestation of semi-daily anomalies in the daily variation of gravity;
- Features of manifestations in tidal processes;
- Significantly low values of the density of giant planets;
- Precession of perihelion of artificial Earth satellites.

The existence of gravitational shielding reveals the essence and clarifies the mechanisms of the observed phenomena and assumptions.

5. Conclusion

1) A study of the daily variation of gravity for the manifestation of gravitational shielding by the planet Earth was carried out. It is established that the gravitational shielding of physical bodies from the Earth causes the manifestation of half-day factors in the daily change in gravity. The results obtained are in satisfactory agreement with the experimental data.

2) It is shown that the foundations of existing physical theories on tidal processes are not convincing. The factors on which they are built have values 10 times lower than those observed.

3) Due to the material looseness of ordinary substances (unlike nuclear matter), gravitational shielding in them can manifest itself with a sufficiently large thickness. There is a dependence of the degree of gravitational shielding on the thickness and size of the object.

4) Gravitational shielding leads to a local change in the value of the gravitational interaction constant G.

5) The mutual shielding of the planets of the Solar system is considered as the cause of the precession of the perihelion of Mercury. Gravitational shielding from the Earth is considered to be the cause of disturbances in the movement of artificial Earth satellites.

6) It is suggested that due to gravitational shielding, not all matter in massive cosmic bodies participates in the act of gravitational interaction, there is a hidden matter that is closed from interaction.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Allais, M. F. C. (1959). *Should the Laws of Gravitation Be Reconsidered?* Parts 1 and 2. *Aero/Space Engineering, 18,* 46-52+51-55.

Antonov, Yu. V., Antonova, Yu., & Volkova, N. (2010). Rezul'taty sinkhronnykh nablyudeniy lunno-solnechnykh variatsiy sily tyazhesti v razlichnykh shirotakh (Saratov i Bishkek). *Vestnik VGU, seriya: Geologiya, , № 1, yanvar'–iyun',* 213-216.

Antonov, Yu. V. & Vorontsova, Ye. V. (2011). Uchet nul'-punkta gravimetrov pri obrabotke nablyudeniy lunno-solnechnykh variatsiy sily tyazhesti. *Vestnik VGU, seriya: Geologiya, No. 2, iyul'-dekabr',* 167-171.

Antonov, Yu. V. (2019). *Dependence of Non-Tidal Variations of Gravity on the Temperature Regime of the Boundary Layer of the Atmosphere*. Vestnik VGU, seriyageologiya, No. 4, 90-94.

Arnautov, G. P., Kalish, Ye. N., Stus, Yu. F., Smirnov, M. G., Bunin, I. A., & Nosov, D. A. (2009). Izmereniye variatsiy sily tyazhesti vo vremya solnechnykh zatmeniy 31 iyulya 1981 g. I 1 avgusta 2008 g. po rezul'tatam gravimetricheskikh nablyudeniy v novosibirskoy oblasti. *Sb. nauchn. tr. Izdatel' YU.A. Nikolayev*. – Nizhniy Novgorod.

Arnautov, G. P. (2005). Rezul'taty mezhdunarodnykh metrologicheskikh sravneniy absolyutnykh lazernykh ballisticheskikh gravimetrov. *Avtometriya, 41,* 126-136.

Arnautov, G. P., Kalish, Ye. N., Smirnov, M. G., Stus, Yu. F., & Tarasyuk, V. G. (1994). Lazernyy ballisticheskiy gravimetr GABL-M i rezul'taty nablyudeniy sily tyazhesti. *Avtometriya, No. 3,* 3-11.

Dirac P.A. (1963). The Evolution of the Physicist's Picture of Nature. *Scientific American, 208,* 45-53. https://doi.org/10.1038/scientificamerican0563-45

Duif Chris, P. (2004). *A Review of Conventional Explanations of Anomalous Observations during Solar Eclipses*. arXiv:gr-qc/0408023.

Duif Chris, P. (2011). Conventional Explanations of Anomalous Observations during Solar Eclipses. In H. A. Múnera (Ed.), *Should the Laws of Gravitation Be Reconsidered?* (pp. 265-282). Apeiron.

Edwards, Q. (2002). *Pushing Gravity* (324 p). Apeiron. https://doi.org/10.1136/bmj.324.7329.63

Gusev, Ye. V. (2006). *Metody polevoy geofiziki* (p. 17). *Izdatel'stvo TPU*.

Jeverdan, G. T., Rusu, G. I., & Antonescu, V. (1999). Expérience à l'aide du pendule de Foucault pendant l'éclipse du soleil du 15 fevrier 1961. *Science et Foi, 15,* 36-44.

Kiernan, V. (1995). Gravitational Constant Is up in the Air. *New Scientist*, 26 Apr., 18.

Majorana, Q. (1920). On Gravitation. Theoretical and Experimental Researches. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, 39,* 488-504. https://doi.org/10.1080/14786440508636063

Majorana, Q. (1930). Quelques recherches sur l'absorption de la gravitation par la matière. *Journal de Physique et Le Radium, 1,* 314-324. https://doi.org/10.1051/jphysrad:0193000109031400

Maksimov, I. V. (1970). *Geofizicheskiye sily i vody okeana* (447 str). Gidrometeoizdat.

Melchior, P. (1966). *The Earth Tides* (483 p). Pergamon Press.

Olenici, D., & Pugach, A. (2012). Precise Underground Observations of the Partial Solar Eclipse of 1 June 2011 Using a Foucault Pendulum and a Very Light Torsion Balance. *International Journal of Astronomy and Astrophysics, 2,* 204-209. https://doi.org/10.4236/ijaa.2012.24026

Olenici, D., Pugach, A. F., Cosovanu, I., Lesanu, C., Deloly, J.-B., Vorobyov, D., Delets, A., & Olenici-Craciunescu, S.-B. (2014). Syzygy Effects Studies Performed Simultaneously with Foucault Pendulums and Torsinds during the Solar Eclipses of 13 November 2012 and 10 May 2013. *International Journal of Astronomy and Astrophysics, 4,* 39-53. https://doi.org/10.4236/ijaa.2014.41006 http://file.scirp.org

Orlov, A. Ya. (1915). Rezul'taty Yur'yevskikh, Tomskikh i Potsdamskikh nablyudeniy nad lunno-solnechnymi deformatsiyami Zemli. *Zapiski Novorossiyskogo un-ta fiz.-mat. fakul'teta.* Odessa, 283 s.

Portilla, M. (2021) Inertial and Gravitational Mass in General Relativity and Their Cosmological Consequences. *Journal of Modern Physics, 12,* 1729-1748. https://doi.org/10.4236/jmp.2021.1213101

Pratt, D. (2001). *Gravity and Antigravity. Part 1.* https://www.davidpratt.info

Proshkina, Z. N., Valitov, M. G., Kulinich, R. G., & Kolpashchikova, T. N. (2015). Izucheniye prilivnykh variatsiy sily tyazhesti v zone perekhoda ot kontinenta k Yaponskomu moryu. Vestnik KRAUNTS. Nauki o Zemle. №3, vypusk №27.

Radzhabov T.M. (2021). On the Missed Opportunities of Classical Physics. *Physics Essays, 34,* 475-479. https://doi.org/10.4006/0836-1398-34.4.475

Radzhabov, T. M. (2022). Mass-Area Equivalence in Classical Physics and Aspects of Mutual Shielding of Objects. *Physics Essays, 35,* 175-180. https://doi.org/10.4006/0836-1398-35.2.175

Radziyevskiy, V. V. (2004). O gravitatsionnom effekte solnechnykh zatmeniy i yego izmerenii // Poiski mekhanizma gravitatsii. *Sb. nauchn. tr. Izdatel' YU.A. Nikolayev.* – Nizhniy Novgorod.

Roseveare N. T. (1982). Mercury's Perihelion. In *From Le Verrier to Einstein* (208 p). Oxford University Press.

Russell H.N. (1921). On Majorana's Theory of Gravitation. *Astrophysical Journal, 54,* 334-346. https://doi.org/10.1086/142649

Sarycheva, Yu. K., Timofeyev, V. Yu., & Khomutov, S. Yu. (2004). Gravimetricheskiye nablyudeniya na dvukh prilivnykh stantsiyakh v Sibiri vo vremya solnechnogo zatmeniya 9 marta 1979 g. // Sb. nauchn. tr. Izdatel' YU.A. Nikolayev. – Nizhniy Novgorod.

Savrov, L. A. (2004). Eksperimental'nyye poiski pogloshcheniya gravitatsii i pyatoy sily // *Sb. nauchn. tr. Izdatel' YU.A. Nikolayev.* – Nizhniy Novgorod.

Sizov, R. (2019) Intra-Atomic Gravitational Shielding (Lensing), Nuclear Forces and Radioactivity. *Journal of Modern Physics, 10,* 59-73. https://doi.org/10.4236/jmp.2019.101006

Spolter, P. (2005). *Gravitational Force of the Sun* (p. 117). Orb Publishing Company.

Van Flandern, T. (1996). Possible New Properties of Gravity. *Astrophysics and Space Science, 244,* 249-261. https://doi.org/10.1007/BF00642296

Vezzoli Gary, C. (2004). Gravitational Data during the Syzygy of May 18, 2001 and Related Studies. *Infinite Energy, 9,* 18-27. http://infinite-energy.com

Wang, Q.-S., Yang, X.-S., Wu, C.-Z., Guo, H.-G., Liu, H.-C. and Hua, C.-C. (2000). Precise Measurement of Gravity Variations during a Total Solar Eclipse. *Physical Review D, 62,* Article ID: 041101. https://doi.org/10.1103/PhysRevD.62.041101

Wu N. (2003, July 23). *Gravitational Shielding Effects in Gauge Theory of Gravity*. arXiv:hep-th/0307225.

Yuzefovich, A. P., & Ogorodova, L. V. (1980). *Gravimetriya* (320 s). *Uchebnik dlya vuzov*. M.: "Nedra".

Yang, X.-S., & Wang, Q.-S. (2002). Gravity Anomaly during the Mohe Total Solar Eclipse and New Constraint on Gravitational Shielding Parameter. *Astrophysics and Space Science, 282,* 245-253. https://doi.org/10.1023/A:1021119023985 http://eclipse2006.boun.edu.tr

Zhou, S.-W. (1999). Abnormal Physical Phenomena Observed When the Sun, Moon, and Earth Are Aligned. *21st Century Science and Technology,* 55-61.