

# THREE THEOREMS FROM WHICH FOLLOW TWO NEW LAWS OF GRAVITATION AND A NEW LAW OF UNIVERSAL GRAVITATION.

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***Abstract.** New theorems on the flux of the gravitational field strength vector are presented, free from the limitations inherent in Gauss's theorem. Gauss's theorem is not sufficient for a complete description of gravity. It is shown that the relationship between the gravitational field flux and the mass of sources is not the only method for representing the gravitational field flux. Unlike Gauss's theorem, the new theorems do not include the mass of sources. The first theorem establishes a relationship between the flux of the gravitational field strength vector and the parameters of the body's orbit. The second theorem establishes a relationship between the flux of the gravitational field strength vector and the parameters of the universe. The third theorem concerns the total gravitational force that actually acts on the body and is caused by the gravitational interaction of the test body with all bodies in the universe. From these theorems, two new laws of gravitation and a new law of universal gravitation are derived, which for the first time describes gravity taking into account the action of all bodies in the universe. Unlike Newton's law of gravity, the new law of universal gravitation does not include the mass of sources and the gravitational constant  $G$ . The new theorems relate to the gravitational field, which obeys the inverse-square law, and to the gravitational field of the universe, where the inverse-square law does not apply. The new theorems and new laws of gravity provide a complete description of the gravitational interactions of all  $N$ -body bodies in the universe. The new theorems demonstrate the existence of a workaround instead of searching for a direct solution to the gravitational  $N$ -body problem (for  $N \geq 3$ ).*

***Keywords:** Gauss's theorem, gravitational field strength vector, cosmological force law, Hooke-Kepler's law of gravitation, law of universal gravitation, universal gravitation theorem, local gravitation theorem.*

## 1. Introduction

In mathematical physics, there are a number of fundamental theorems that prove the properties of gravity and the behavior of matter. These include Newton's spherical shell theorem, the Maclaurin-Laplace theorem on the attraction of ellipsoids of revolution, the Penrose-Hawking singularity theorems, Birkhoff's theorem on the Schwarzschild metric, and Gauss's theorem on the gravitational flux through a closed surface.

Gauss's law for the gravitational field relates the flux of the gravitational field strength vector to the mass of the sources. Newton's law of gravitation follows from Gauss's theorem. Both Newton's law of gravitation and Gauss's theorem include gravitational mass as a parameter.

Here we show that gravitational mass is neither the only nor the best parameter for determining the gravitational field strength vector flux and the law of gravity. Below, we demonstrate that the flux of the gravitational field strength vector through a closed surface is directly related to the orbital parameters and integral parameters of the Universe, and we present new theorems for gravity. We also

demonstrate that Newton's law of gravitation is not the only physical law representing the gravitational force. Based on these new theorems, we derive new laws of gravity that are more accurate and perfect than Newton's law of universal gravitation.

## 2. Gauss's Theorem of Gravitation.

The Gauss Theorem of Gravitation is a fundamental law establishing the relationship between the flux of the gravitational field strength vector  $g$  through a closed surface and the mass within the closed surface. Gauss's law for the gravitational field states that the flux of the gravitational field strength vector  $g$  through a closed surface is proportional to the mass of the sources:

$$\Phi_g = \oint_S g \cdot dS = -4\pi GM \quad (1)$$

Where:  $\Phi_g$  is the gravitational field flux,  $g$  is the gravitational field strength vector,  $dS$  is the surface area element,  $G$  is the gravitational constant,  $M$  is the total mass inside the surface.

Gauss's theorem is valid for a gravitational field that obeys an inverse-square law. The minus sign indicates that gravitational forces are always attractive (the lines of force enter the surface), unlike electrostatics, where the flux can be positive or negative. The mathematical formulation of Gauss's theorem for forces depending on the inverse square of the distance was first systematically presented by Gauss in 1839 [1]. The very idea of the flux of the gravitational field strength vector through a closed surface began to take shape in the works of Lagrange in 1773. In his work on the attraction of ellipsoids, Lagrange first mathematically derived the relationship between the flux of the gravitational field strength vector and mass [2]. Lagrange found the "seed" of the idea in gravity, and Gauss transformed it into a universal law of nature and a powerful mathematical tool. Gauss showed that for any field obeying an inverse-square law (whether gravity or electrostatics), the flux through a closed surface is determined exclusively by the sources within that surface.

From Gauss's theorem, Newton's law of two-body gravity, which also obeys an inverse-square law, is derived. However, Gauss's theorem cannot be used to derive the law of gravitation, which describes the gravity of all  $N$  bodies in the universe where the inverse-square law does not apply. Gauss's theorem is not sufficient to solve this problem. This is the limit of applicability of Gauss's theorem for gravity. Furthermore, Gauss's law for the gravitational field uses the mass of the sources " $M$ " as a parameter, which is not a primary empirical fact but is calculated from observed orbits. Gauss's theorem for gravity is applicable on small scales. On the scale of the universe, Gauss's theorem is not applicable.

In electromagnetism, the flux of the electric field strength vector is associated only with electric charge. It is proportional to the total electric charge located inside the surface. Electric charge is an observable physical quantity and is included in Gauss's law as a parameter. In gravity, the situation is different. Gauss's theorem implies that the flux of the gravitational field strength vector is related to the mass of the sources. Gauss's law for gravity includes a secondary parameter - mass, but does not include the actually observable primary physical quantities: distances and periods of revolution of celestial bodies.

It is known that the central mass determines the parameters of the body's orbit. Therefore, the flux of the gravitational field strength vector can be expressed in fundamentally different ways: through the field source (the mass inside) and through the kinematic parameters of the test body's

orbit. The first method is represented by Gauss's theorem. There is no theorem for the second method. One must formulate it. This is a theorem relating the flux of the gravitational field strength vector to the kinematic parameters of the orbit. The value of such a theorem is that the orbit is a primary empirical fact. We consider the orbital parameters (observed data) as the primary basis for determining the magnitude of the gravitational flux.

All of the above suggests that Newton's law of gravitation is not the only law of gravitational interaction. Since Newton's law, which includes the mass "M", is derived from Gauss's theorem, a new law of gravity will follow from the new theorem, which will not include the mass "M". Therefore, it is of interest to consider how the flow of the gravitational field strength vector is related to the orbital parameters.

### 3. Theorem on the relationship between the flux of the gravitational field strength vector and orbital parameters.

**THEOREM 1.** (Theorem on the relationship between the flux of the gravitational field strength vector and orbital parameters): *"The flux of the gravitational field strength vector  $g$  through any closed surface  $S$  is expressed in terms of the parameters of the body's elliptical orbit and is proportional to the ratio of the cube of the semimajor axis  $R^3$  to the square of the body's orbital period  $T^2$ ."*

Theorem 1 is represented by the mathematical formula in Figure 1:

$$\Phi_1 = \oint_S g \cdot dS = -4\pi R^3 / T^2$$

Fig. 1. Mathematical formula for the relationship between the flux of the gravitational field strength vector and the orbital parameters. Where:  $\Phi_1$  is the gravitational field flux,  $g$  is the gravitational field strength vector,  $dS$  is the surface area element, and  $R$  and  $T$  are the orbital parameters.

Here, we use the number of revolutions per unit time ( $1/T$ ) rather than radians per unit time ( $2\pi/T$ ) as units for measuring the frequency. This simplifies the formulas, eliminates dimensionless coefficients, and makes them coherent.

The proof of Theorem 1 is based on combining the geometric properties of the field (Gauss's law) and the dynamics of the body's motion in the gravitational field of the source (Kepler's law).

The ratio of  $R^3$  to the square of the orbital period  $T^2$  is an invariant for the test mass in the gravitational field of the source. It can be used to express the magnitude of the flux of the gravitational field strength vector without knowing the mass "M" itself directly.

Theorem 1 applies to a gravitational field if its intensity decreases inversely with the square of the distance from the source. This is its similarity to Gauss's theorem. It differs from Gauss's theorem in that Theorem 1 operates not with the mass "M," but with the kinematic parameters of the orbit  $R$  and  $T$ , which are the primary empirical fact.

#### 4. Deriving a new law of gravity from Theorem 1.

Let's consider which law of gravity follows from Theorem 1. For simplicity, consider a Gaussian sphere of radius  $r$ . The field strength vector  $g$  at any point on this sphere is directed toward the center, and the magnitude of  $g$  is the same at all points on the sphere's surface. The flux of the field strength vector  $g$  through the sphere's surface is equal to the product of the field strength and the sphere's area:

$$\Phi_g = \oint_S g \cdot dS = g \cdot (4\pi r^2) \quad (2)$$

According to Theorem 1, this flow is equal to:

$$\Phi_g = -4\pi R^3 / T^2 \quad (3)$$

From here:

$$\Phi_g = -4\pi R^3 / T^2 = g \cdot (4\pi r^2) \quad (4)$$

Field strength  $g$ :

$$g = -R^3 / r^2 T^2 \quad (5)$$

Since the field strength  $g$  is the force acting on a unit mass ( $g = F/m$ ), we obtain a new law of gravity based only on the field geometry and orbital parameters:

$$F = mR^3 / r^2 T^2 \quad (6)$$

The new law of gravity shows the magnitude of the force for the local gravitational interaction of two bodies. In [3], we called this law of gravity the Hooke-Kepler law (Fig. 2).

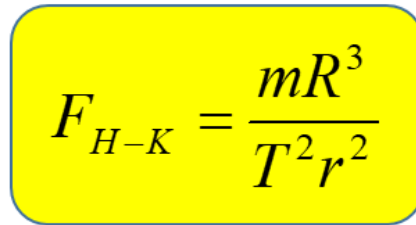

$$F_{H-K} = \frac{mR^3}{T^2 r^2}$$

Fig. 2. The Hooke-Kepler law of gravitation. Where  $m$  is the mass of the body,  $R$  and  $T$  are the orbital parameters, and  $r$  is the distance.

This is a more refined and accurate law of gravitation than Newton's law. It reflects the local force of gravitational interaction between two bodies. Instead of mass, it includes orbital parameters, since the orbit is the primary empirical fact. An approximate verbal formula for this law of gravitation, with an emphasis on the Keplerian orbit, was first formulated by Robert Hooke in 1679 [4]. However, Newton preferred mass over orbital parameters. As a result, a more refined and accurate law of gravitation between two bodies remained undiscovered.

## 5. Theorem on the relationship between the flux of the gravitational field strength vector and the parameters of the Universe.

The relationship between the flux of the gravitational field strength vector and the parameters of the Universe is established by Theorem 2.

**THEOREM 2.** (Theorem on the relationship between the flux of the gravitational field strength vector and the parameters of the Universe). "*The flux of the gravitational field strength vector  $g_U$  through a closed surface  $S_U$  of the Universe is equal to the product  $4\pi c^2 R_U^2 \sqrt{\Lambda}$ .*"

Theorem 2 is represented by the mathematical formula in Figure 3:

$$\Phi_{Cos} = \oint_S g_U \cdot dS_U = -4\pi c^2 R_U^2 \sqrt{\Lambda}$$

Fig. 3. Theorem on the relationship between the flux of the gravitational field strength vector and the parameters of the Universe. Where:  $\Phi_{Cos}$  is the flux of the gravitational field of the Universe,  $g_U$  is the gravitational field strength vector of the Universe,  $dS_U$  is the surface area element,  $c$  is the speed of light,  $R_U$  is the radius of the Universe, and  $\Lambda$  is the cosmological constant.

The resulting gravitational field of the Universe is the vector sum of the gravitational fields generated by each object in the Universe. If the gravitational field is generated by several sources, then the flux of the resulting field vector through a closed surface is equal to the sum of the fluxes of the field vectors generated by each source individually:

$$\Phi_{Cos} = \oint_S g_1 \cdot dS + \oint_S g_2 \cdot dS + \dots + \oint_S g_n \cdot dS \quad (7)$$

We consider the Universe as a whole, so the gravitational flux through a closed surface is directly related to the parameters of the Universe. Using the parameters of the Universe eliminates the problem associated with the unknown value of "n" in equation (7). Direct summation of the forces from an infinite number of stars leads to a false infinite result (Seeliger's gravitational paradox). Einstein was the first to realize that Gauss's theorem leads to a contradiction: If the Universe is infinite and uniformly filled with mass, then the gravitational flux through any closed surface must tend to infinity. Einstein introduced the cosmological constant  $\Lambda$  into the equation, but later renounced it [5]. The rejection of the cosmological constant  $\Lambda$ , according to many scientists, was Einstein's greatest mistake. ("Einstein's greatest mistake was that he called the cosmological constant his greatest mistake") [6,7]. Physics does not operate with infinities. In a finite Universe, the mass of the entire Universe can be considered a separate source of the gravitational field. This mass creates a flux  $\Phi_{Cos}$  of the field strength vector  $g_U$ .

The total gravitational field strength from the entire Universe is defined as:

$$g_U = \sum_{i=1}^n g_i = c^2 \sqrt{\Lambda} \quad (8)$$

Where:  $c$  is the speed of light,  $\Lambda$  is the cosmological constant.

The area of the Gaussian sphere for the Universe:

$$S_U = 4\pi R_U^2 \quad (9)$$

We substitute the value of  $g_U$  and the value of  $S_U$  into the definition of the flow:

$$\Phi_{Cos} = \oint_S g_U \cdot dS_U = -g_U \cdot 4\pi R_U^2 = -4\pi R_U^2 c^2 \sqrt{\Lambda} \quad (10)$$

Theorem 2 is valid for the gravitational field created by all bodies in the Universe where the inverse square law does not apply.

## 6. Deriving a New Law of Gravity from Theorem 2.

Let's consider which physical law of gravity would derive from Theorem 2. For simplicity, we'll consider the universe as a Gaussian sphere of radius  $R_U$ . The field strength vector  $g_U$  at any point on this sphere is directed toward the center, and the magnitude of  $g_U$  is the same at all points on the sphere's surface.

The flux of the field strength vector  $g_U$  through the surface of the sphere is equal to the product of the field strength and the sphere's area:

$$\Phi_{Cos} = \oint_S g_U \cdot dS_U = -g_U \cdot (4\pi R_U^2) \quad (11)$$

According to Theorem 2, this flow is equal to:

$$\Phi_{Cos} = -4\pi c^2 R_U^2 \sqrt{\Lambda} \quad (12)$$

From here:

$$\Phi_{Cos} = -4\pi c^2 R_U^2 \sqrt{\Lambda} = -g_U \cdot (4\pi R_U^2) \quad (13)$$

Field strength  $g_U$ :

$$g_U = c^2 \sqrt{\Lambda} \quad (14)$$

Since the field strength  $g_U$  is the force acting on a unit mass ( $g_U = F/m$ ), we obtain a new law of gravity based only on the field geometry and the parameters of the Universe:

$$F = mc^2 \sqrt{\Lambda} \quad (15)$$

The new law of gravity shows the magnitude of the gravitational force of all bodies in the Universe. In [8, 9], we called this law of gravity the law of cosmological force:

$$F_{Cos} = mc^2 \sqrt{\Lambda}$$

Fig. 4. The law of cosmological force. Where  $m$  is the mass of the object,  $c$  is the speed of light, and  $\Lambda$  is the cosmological constant.

This new law of gravitation describes the attractive force exerted by the entire mass of the universe on a test mass. This is the part of the gravitational force that Newton's law "does not detect." Instead of the gravitational constant  $G$ , the law of cosmological force contains the cosmological constant  $\Lambda$ . The new law of gravitation shows that any body of mass  $m$  experiences a cosmological force proportional to its mass and the cosmological constant  $\Lambda$ . The cosmological force is linear in mass and does not obey the inverse-square law. On small scales, the additional cosmological force is significantly smaller than the Newtonian force. On the scale of the universe, the cosmological force is enormous. In the limit, it is exactly equal to the Planck force:

$$\lim_{m \rightarrow M_U} F_{Cos} = \lim_{m \rightarrow M_U} mc^2 \sqrt{\Lambda} = \frac{c^4}{G} = 1.21027 \cdot 10^{44} N$$

Fig. 5. Limiting value of the cosmological force  $F_{Cos}$ .

The theoretical limit of the cosmological force at  $m \rightarrow M_U$  reaches the enormous value  $c^4/G = 1.21027 \times 10^{44}$  N. At large distances, the main part of the universal gravitational force is the cosmological force  $F_{Cos}$ .

The cosmological force  $F_{Cos}$  is derived from Theorem 2. It replaces the complex (impossible!) calculation of Newtonian forces on the scale of the Universe. The factor  $mc^2$  relates the cosmological force to the rest energy of the body, demonstrating that the gravitational field of the Universe interacts directly with the energy potential of the test body.

## 7. The Theorem of Universal Gravitation

Here we present a new law of universal gravitation that takes into account the gravitational pull of all bodies in the universe. Hooke gave an approximate verbal formula for the law of universal gravitation as early as 1679, seven years before the publication of Newton's Principia [4, 9]. Newton rejected Hooke's proposal, solving the two-body problem. This idealized model of two-body gravitation proved inapplicable to the real universe. Through the efforts of popularizers, Newton's law was called the law of universal gravitation [4]. Newton never called his two-body gravitational law the law of universal gravitation. The real law of universal gravitation, which takes into account the gravitational pull of all bodies in the universe, remained undiscovered. Theorem 3 provides a solution to this problem, outlined in Hooke's verbal formula.

**THEOREM 3.** (Theorem of Universal Gravitation). *"The total gravitational force acting on a body is equal to the sum of the local gravitational force of the two bodies and the gravitational force of all bodies in the Universe (the cosmological force)."*

Theorem 3 is represented by the formula (Fig. 6):

$$F_U = \frac{mR^3}{T^2 r^2} + mc^2 \sqrt{\Lambda}$$

Fig. 6. Law of universal gravitation. Where:  $m$  is the mass of the body,  $R$  and  $T$  are the orbital parameters,  $r$  is the distance,  $c$  is the speed of light in a vacuum, and  $\Lambda$  is the cosmological constant.

The proof of the law of universal gravitation follows from the superposition of the fluxes of the gravitational field strength vectors and the linearity of the integral. The resulting gravitational field at any point in space is the vector sum of the gravitational fields generated by each source individually. If the gravitational field is generated by multiple sources, then the flux of the total gravitational field strength vector through a closed surface is equal to the sum of the fluxes of the strength vectors.

$$\Phi_U = \Phi_1 + \Phi_{Cos} \quad (16)$$

Figure 7 shows the formula for the total flux  $\Phi_U$ , represented by the orbital parameters and the parameters of the universe.

$$\Phi_U = \oint_S \mathbf{g} \cdot d\mathbf{S} + \oint_S \mathbf{g}_U \cdot d\mathbf{S}_U = -4\pi (R^3 / T^2 + c^2 R_U^2 \sqrt{\Lambda})$$

Fig. 7. Total flux  $\Phi_U$  represented by orbital parameters and Universe parameters.

In the real Universe, the total force acting on a body is composed of the local gravitational force (Hooke-Kepler's law) and the cosmological force  $F_{cos}$ . This eliminates the need to sum up billions of force vectors from distant galaxies and allows us to account for their influence with a single simple equation.

## 8. Rethinking Gauss's law for the gravitational field.

A drawback of Gauss's law for the gravitational field is that it does not provide a complete mathematical description of the gravity of the Universe. Gauss's law includes mass, but does not include observable physical quantities: distances and orbital periods of celestial bodies. This article rethinks the approach to calculating the flux of the gravitational field vector. This primarily involves abandoning mass as the main parameter and switching to motion parameters. In classical physics, the gravitational field flux  $\Phi_g$  is tied to the mass "M" ( $\Phi_g = -4\pi GM$ ). It is proposed to use the geometric and kinematic parameters of the Universe and the orbits of bodies instead of mass to determine the flux of the gravitational field vector.

We have shown that expressing the flux of the gravitational field vector in terms of mass (Gauss's theorem) is not the only or best way to describe gravity. Gauss's theorem has a limit to its applicability: it "does not see" the flux of the gravitational field vector from all bodies in the Universe where the inverse-square law does not apply. Theorem 1 provides a new expression for the flux of the gravitational field vector, where the flux of the gravitational field vector  $\Phi_g$  is determined through the empirical parameters of the body's orbit (R) and (T) ( $\Phi_1 = -4\pi R^3/T^2$ ). Theorem 1 completely eliminates the gravitational mass "M" from the equation. Instead, the gravitational flux is calculated using the observed parameters of the object's orbit. This allows one to find the flux of the gravitational field vector without knowing the masses of the sources.

Both Gauss's theorem and Theorem 1 concern attractive forces acting inversely proportional to the square of the distance. The advantage of Theorem 1 is that it operates with the observable

parameters "R, T" and does not require the mass "M." Theorem 1 derives a local gravitational force that describes the gravity of two bodies more accurately than Newton's law of gravity. This new law of two-body gravity does not include the mass "M" or the gravitational constant "G."

## **9. Rethinking Newton's Law of Universal Gravitation.**

For a long time, gravitational force was represented by a single law—Newton's law of gravitation. The uniqueness and singularity of Newton's law of gravitation led popularizers to overestimate its status. The real law of universal gravitation, which takes into account the gravity of all (N) bodies in the universe, remained undiscovered.

Newton's classical law of universal gravitation is an idealized mathematical model developed to solve the two-body gravitational problem. Its parameters include the mass "M" and the gravitational constant "G." Gauss's theorem for gravitation is also an idealized mathematical model. It also concerns attractive forces acting inversely proportional to the square of the distance, and also uses the mass "M" and the gravitational constant "G" as parameters. These mathematical models prove untenable when applied to the real universe, in which all (N) bodies in the universe participate in gravitational interactions.

New laws of gravity were derived from Theorem 1 and Theorem 2. Combining the local law  $F_{H-K} = mR^3/T^2r^2$  and the cosmological force law  $F_{Cos} = mc^2\sqrt{\Lambda}$  yields the law of universal gravitation, where the resulting gravitational force is formed from these two components. The new theorems made it possible to obtain a general analytical solution that takes into account the gravity of all bodies in the universe, bypassing the direct solution of the N-body problem. The actual law of universal gravitation turned out to have two components. The first component is the local law of two-body gravity ( $F_{H-K} = mR^3/T^2r^2$ ). The second component takes into account the additional gravitational force of all bodies in the universe ( $F_{Cos} = mc^2\sqrt{\Lambda}$ ), which always acts on a test body but has always eluded researchers.

## **10. A workaround for the unsolvable N-body gravitational problem.**

Scientists continue to search for new approaches and specific solutions to the N-body problem. The traditional N-body problem in Newtonian physics is incredibly complex because it requires precise calculations of the pairwise attractive forces between multiple objects, which does not lead to a general closed-form analytical solution.

We propose a change in this approach: Instead of summing the gravitational forces from each of the infinite number of objects in the Universe (which is mathematically impossible), we should combine the gravitational action of all bodies in the Universe into a single general law using the integral parameters of the Universe. Then, the gravitational force can be determined not using the masses of the bodies, but by using the geometric parameters of the bodies' orbits and the general parameters of the Universe. Removing the constant "G" and mass "M" as parameters in gravitational equations opens up new possibilities. This is a very promising "workaround" that replaces the direct solution of the classical N-body problem (for  $N \geq 3$ ).

## **11. Rethinking the N-body Gravitational Problem and Transitioning to the Inverse N-body Problem.**

Three new theorems provide a complete mathematical model of the Universe's gravity that does not require a direct solution to the N-body problem. The new approach involves transitioning from the "direct" N-body problem to the inverse N-body problem. Instead of specifying initial coordinates for individual masses and attempting to calculate their trajectories (the direct problem), we formulated the inverse N-body problem [10]. To solve the inverse N-body problem, known integral (observable) characteristics of the Universe as a single system are used as parameters in the equations. This allows us to reduce the N-body problem to an equivalent two-body problem, where the central object is the entire N-body system as a single whole. The gravitational field strength integrates the influence of all individual masses. This allows us to eliminate the mass "M" and the constant "G" from the equations.

Classical physics requires knowledge of the masses of all N bodies. In our formulas, the mass "M" of the sources and the gravitational constant "G" are absent. At the local level, gravitational attraction is expressed through trajectory parameters (the Hooke-Kepler law). At the global level, the attraction to all other N bodies in the Universe is calculated using the cosmological constant and the speed of light.

New theorems show that does not need to calculate billions of mutual gravitational interactions between all objects in the Universe. The interaction of a body with all bodies in the Universe can be described by a single general equation, knowing only the body's trajectory parameters and the integral parameters of the Universe. Direct solutions to the N-body problem and the search for particular solutions to the N-body problem are no longer relevant.

## **12. A complete mathematical model of gravitational interactions in the Universe that does not require a direct solution to the N-body problem.**

Three new theorems for gravity and new laws of gravity provide a complete description of the gravitational interactions of all N-body bodies in the Universe. Theorem 1 and Gauss's theorem are two different ways of expressing the flux of the gravitational field strength vector. When the orbits are known, Theorem 1 is effective. When the masses are known, Gauss's theorem is effective. Theorem 1 does not replace, but rather complements, Gauss's theorem.

Theorem 2 circumvents the N-body problem by changing the very approach to calculations: instead of pairwise summation of forces between an infinite number of bodies, the parameters of the Universe as a single system are used. Within the framework of classical Newtonian dynamics, an exact solution to the N-body problem is impossible due to the colossal number of equations. The Newtonian approach requires knowing the masses and coordinates of absolutely all bodies in the Universe to calculate their influence on a single point. This is a dead end. We have formulated and solved the inverse N-body problem. The N-body inverse problem does not require summation of local forces. Instead of accounting for billions of individual masses, Theorem 2 allows us to describe the overall background gravitational field of the Universe.

In Theorem 2, the entire Universe is treated as a giant closed sphere. This allows us to calculate the total flux of the gravitational field vector from all external bodies at once, without separating them into individual objects. Theorem 2 concerns the gravitational force, where the inverse-square law does

not apply. Theorem 2 yields a new equation in which the flux of the gravitational field vector is defined through the parameters of the Universe. Here, the flux is related to the radius of the Universe "RU," the speed of light "c," and the cosmological constant " $\Lambda$ ," which the classical Gaussian theorem cannot describe. From Theorem 2, we derive a complementary force that has a linear dependence on the mass of the test body and does not obey the inverse-square law.

Theorem 3 provides a mathematical model of gravitational interactions throughout the Universe without directly solving the N-body problem and leads to a new law of universal gravitation. This new law of universal gravitation, which takes into account the gravity of all N-body bodies in the Universe, is represented by a complete analytical equation.

The new theorems demonstrate the existence of a workaround instead of searching for a solution to the N-body gravitational problem (for  $N \geq 3$ ). Thus, there is no need to solve the N-body problem, because the influence of these "N" bodies is already embedded in the geometry itself and in the constants of the Universe.

### **13. Conclusion.**

Newton, in his mathematical formulation of the law of gravitation, and Gauss, in his mathematical formulation of the theorem on the flux of the gravitational field strength vector, used gravitational mass. Both Newton and Gauss ignored observable parameters, such as orbital parameters and the parameters of the universe. The price of this "inattention" is the undiscovered laws of gravity more perfect than Newton's law of gravity.

Rejecting gravitational mass as a parameter for determining the flux of the gravitational field strength vector, in favor of orbital parameters, leads to three new theorems, from which a new law of universal gravitation is derived without the gravitational constant G. This new law of universal gravitation, for the first time, yields a real gravitational force taking into account the gravitational attraction of all bodies in the universe. As a result, the low accuracy of the gravitational constant G ceases to be a problem in gravity theory. The N-body gravitational problem, which has no analytical solution, ceases to be a problem in gravity theory, since new theorems demonstrate the existence of a workaround for taking into account the gravitational attraction of all bodies in the Universe instead of searching for a solution to the N-body gravitational problem (for  $N \geq 3$ ).

### **14. Final Remarks.**

1. Gravitational mass is neither the only nor the best parameter for the law of universal gravitation and for determining the flux of the gravitational field strength vector.

2. The flux of the gravitational field strength vector through a closed surface can be expressed in three fundamentally different ways: through the source of the field (the mass within), through the kinematic parameters of the orbit of a test body, and through the parameters of the Universe. These three approaches demonstrate that gravitational flux is a fundamental quantity linking the local distribution of mass, the motion of objects, and the large-scale structure of the Universe.

3. Gauss's theorem is insufficient for a complete description of gravity. Gauss's theorem allows one to express the flux of the gravitational field strength vector through the field source (the mass within), but does not allow one to express it through the kinematic parameters of the orbit of a test body or through the parameters of the Universe.

4. Three new theorems are presented, from which two new laws of gravitation and a new law of universal gravitation follow. The new theorems apply both to gravitational fields that obey the inverse-square law and to the gravitational field of the Universe, where the inverse-square law does not apply.

5. Theorem 1 is a theorem on the relationship between the flux of the gravitational field strength vector and the orbital parameters. Theorem 1 applies to a gravitational field if its intensity decreases inversely with the square of the distance from the source. This is its similarity to Gauss's theorem. It differs from Gauss's theorem in that Theorem 1 operates not with the mass "M," but with the kinematic parameters of the orbit.

6. Theorem 2 is a theorem on the relationship between the flux of the gravitational field strength vector and the parameters of the universe. Theorem 2 is valid for the gravitational field created by all bodies in the universe, where the inverse-square law does not apply.

7. Theorem 3 is a theorem of universal gravitation. Theorem 3 states that the total gravitational force acting on a body is equal to the sum of the local gravitational force of the two bodies and the gravitational force of all bodies in the universe (the cosmological force).

8. Newton's law of universal gravitation is not the only physical law describing the gravitational force. New laws of gravity, more precise than Newton's law, were derived from new theorems.

9. Newton solved the two-body problem. He didn't call his law of gravity the law of universal gravitation. Thanks to the efforts of popularizers who were too far removed from understanding gravity, Newton's law was called the law of universal gravitation. The real law of universal gravitation, which takes into account the gravity of all bodies in the universe, remained undiscovered.

10. The new theorems and new laws of gravity provide a complete description of the gravitational interactions of all N-body bodies in the universe. The new theorems demonstrate the existence of a workaround instead of searching for a solution to the N-body gravitational problem (for  $N \geq 3$ ).

### References.

1. Gauss, C.F. (1877). Allgemeine Lehrsätze in Beziehung auf die im verkehrten Verhältnisse des Quadrats der Entfernung wirkenden Anziehungs- und Abstossungskräfte. In: Werke. Springer, Berlin, Heidelberg. [https://doi.org/10.1007/978-3-642-49319-5\\_11](https://doi.org/10.1007/978-3-642-49319-5_11)

2. Théorie des attractions des sphéroïdes et de la figure des planètes. Œuvres complètes de Laplace , Gauthier-Villars et fils, 1894 , Tome dixième ( p. 347-425)

3. Kosinov, M. (2026). HOOKE-KEPLER LAW OF GRAVITATION: the rejected law of gravitation, which turned out to be more accurate and perfect than Newton's law. *Cambridge Open Engage*. doi:10.33774/coe-2025-53v1v-v9

4. Kosinov, M. (2026). HOW NEWTON'S LAW (THE LAW OF TWO-BODY GRAVITATION) BECAME CALLED THE LAW OF UNIVERSAL GRAVITATION. *Cambridge Open Engage*. doi:10.33774/coe-2026-2wvfk-v5.

5. Einstein, A. (1917) Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie. In: Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften, Verlag Der Bayer Akad D Wiss, Berlin, 142-152.

6. Mario Livio. *Brilliant Blunders: From Darwin to Einstein — Colossal Mistakes by Great Scientists That Changed Our Understanding of Life and the Universe*. Simon & Schuster, 2013. ISBN-13: 978-1439192368.

7. Adam G. Riess and Mario Livio's article "The Puzzle of Dark Energy" was published in the March 2016 issue of *Scientific American*, Volume 314, Issue 3, pages 38–43.

8. Kosinov, M. (2026). WHAT'S WRONG WITH THE LAW OF UNIVERSAL GRAVITATION? What should this law actually look like? *Cambridge Open Engage*. doi:10.33774/coe-2025-p2tdb-v7

9. Kosinov, M. (2026). NEW LAW OF UNIVERSAL GRAVITATION WITHOUT CONSTANT G. *Cambridge Open Engage*. doi:10.33774/coe-2025-tcjtj-v9

10. Kosinov, M. (2025). INVERSE N-BODY PROBLEM - THE KEY TO SOLVING GRAVITY PROBLEMS. *Cambridge Open Engage*. doi:10.33774/coe-2025-7w4k7-v4).