

Model Explaining the Gravitational Force

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The universal gravitation equation of Newton is widely used in the calculations in engineering and astrophysics because it is simple to use and requires little mathematical knowledge. It is a simple equation that describes the gravitational phenomena at low speed and in weak gravitational fields. Although Einstein's general relativity largely supplants the universal gravitation of Newton equation in terms of accuracy, this comes at the price of equations asking heavy mathematical paraphernalia. Due to its amazing simplicity, Newton's theory remains the first basic theory that is taught in most colleges and universities.

Several attempts have been undertaken to understand the real basics of the phenomenon of gravitation, but none answers all the following questions: Do the laws of gravity are really the same everywhere? Does gravitation is due to a particle such as a graviton? Does gravitation is transmitted at the speed of light, or is it instantaneous? Does gravitation apply outside of our universe? Will our universe have, after an expansion phase, a contraction phase that will end up in a Big Crunch?

This document aims to show that it is possible to give a logical basis for the universal gravitation of Newton. We will show that the gravitational attraction is only a concept. The forces do not exist. We are in a huge bath of photons of different wavelengths that hit us in every way and at all times. These repeated impacts create a radiation pressure that is not necessarily the same everywhere in the universe. Just as in a pool, the deeper we are immersed in the universe, the higher the radiation pressure is intense. According to our theory, the objects are not attracted to each other, but rather they are pushed over on each other by the radiation pressure surrounding us. Using this concept, it is possible to calculate the acceleration transmitted to the objects. Circumscribing the experiences within a specific framework (macroscopic objects, moving at low speeds, the distances between objects are relatively small and the gravitational fields involved are weak) and making the concept of force existing, we get the equation of the universal gravitational force of Newton.

KEYWORDS: Gravitation, Newton, Einstein, general relativity

1. INTRODUCTION

In 1686, Isaac Newton presented for the first time an equation describing the gravitational interactions between the different masses. It was not until the advent of Einstein to know that this theory was valid only at low speed and with weak gravitational fields. Although his theory well describes the gravitational phenomena around us, Newton has never issued any justification as to the nature of the gravitational force. He noted its existence and described the theory of gravitation events, nothing more. This theory, however, had the great merit of

being simple to use. Even in our times, despite our current knowledge, we still commonly use Newton's equations because of their simplicity.

In 1915, Einstein presented his theory on general relativity [14]. This is a relativistic theory of gravitation based on completely different grounds from those of Newton. It supersedes the theory of the latter in that it includes the universal Newtonian gravitation theory for low speeds (with respect to the speed of light in vacuum) and the weak gravitational fields. It predicts the behavior of objects even at very high speeds approaching that of light [15]. Already Einstein considered that gravitation is not really a force. He conceived that gravitation as a manifestation of the curvature of space-time that was produced by the distribution of energy in the form of mass or kinetic energy, which differs according to the observer's frame of reference. However, although none of the numerous experimental tests carried out was able to put this theory faulty up to now, this theory does not really explain why space-time is curved by the presence of energy. Although the underlying principle in general relativity is simple, the mathematical arsenal that comes with it is heavy and difficult to understand for everyone. For this reason, when it comes time to be used in practice, this theory often becomes the second choice. But it is essential in many applications such as gravitational lenses, understanding of black holes, the behavior of satellites, the geostationary positioning system (GPS), etc.

It is interesting to know that the general theory of relativity does not allow us to find any new physical constant. The constants must be measured and used in calculations. For this reason, the general theory of relativity uses Newton's theory to "calibrate" itself at low speed.

2. DEVELOPMENT

2.1. Forces do not Exist

Let's start by making the following shocking statement: the gravitational and electrical forces do not exist. No force exists. Forces are concepts accompanied by practical mathematical tools to predict the interaction between different elements of matter. But these simply do not exist.

In this article, we will focus on explaining the different forces and quantify them under the form of equations. As the concept of force is useful and easy to understand, we will show that it is possible to display this concept as a mathematical result and not as an explanation.

2.2. The Photon is Maybe the Most Elementary Particle

Let's suppose that, its most simple representation, all matter is made of confined photons. To convince ourselves, Einstein found the following equation:

$$E = m_0 \cdot c^2 \quad (1)$$

Let's try to find the signification of this equation. It says that it is possible to convert a mass at rest m_0 into a certain amount of energy (photons) by the disintegration of matter. However, this equation is not unilateral. It is also possible to take the same quantity of energy and to convert it into a mass. This equation works bilaterally. If in final, the photons are the result of the disintegration of matter, we conclude that some way, all particles are in reality made of confined photons. The electrons, protons, and neutrons are not the most elementary particles. Not even quarks. It looks like photons are maybe the most elementary existing particles.

2.3. Model Representing the Thermodynamic Vacuum

The vacuum, as we are used to conceiving it, is an absence of molecules and atoms. However, the vacuum is not nothingness as its name could lead us to believe it. The vacuum is full of photons. It is a true bath of electromagnetic wavelengths from $2\pi \cdot L_p$ (where L_p is the Planck length) up to the value of the apparent circumference of the universe $2\pi \cdot R_u$ (where R_u is the apparent radius of curvature of the luminous universe). To avoid any misinterpretation with the term "vacuum" which could lead us to believe that it refers to a total absence of all, history should maybe have kept the original name of « ether » for the vacuum. However, even if we do not like this name and that we try to avoid it, to keep the most recent and used terms, we will keep the name « vacuum ». However, we warn the reader that, for us, the vacuum is full of photons that hit masses on all sides. The "vacuum" is simply a void of matter.

3. THE GRAVITATIONAL FORCE

In a first step, let's try to find a model that explains the gravitational forces with the help of photons that hit the masses in relation.

3.1. The Behavior of Two Microscopic Bodies

When we talk about a microscopic body, we mean a mass that is so small that it is not heavy enough to statistically average out the impacts that it could receive coming from the different photons which surround it to keep, on average, its initial position.

Let's define the mass of an object as being the sum of momentums p of the photons that it is made of, divided by their speed with respect to a given observer.

$$m = \sum \frac{p}{v} \quad (2)$$

Momentum can be of two types: linear or angular. According to this, if the object is at rest relative to the observer, only the rotations count. But if the object is moving in a linear motion, additional momentum will be added. The mass of an object is given by the total momentum divided by the speed (linear or angular) perceived by a given observer. Then we realize, by this definition, that the mass of an object may change depending on the selected observer.

Let's assume that the elementary particles are made of different arrangements of confined photons (with angular momentum). The actual dimension of the photons is of the order of the Planck length, which is to say about 1.6×10^{-35} m. What gives them a greater wavelength than this value, it's their angular speed of rotation. The quicker they turn on themselves the smaller the wavelength is. However, we do not go into the detail of how these photons are confined to form the various bricks that makeup matter. The key here is to say that all the photons have the same physical size, whether confined or not. Let's see them as small beads that are all the same size.

To give an example, let's suppose two of such beads in the presence of one another in a space where there is a complete absence of material, light, and electromagnetic waves. Only those two little beads are in this space. In this experiment, the universe does not exist. We avoid deliberately using the term "vacuum" which is commonly used to describe the space that is presented here because of the vacuum as we normally conceive it is filled with electromagnetic waves.

The two beads, called A and B, will not suffer from any "attraction" because gravitational forces do not exist. If no movement is instilled in these beads relative to one observer at rest, nothing will happen and nothing will move.

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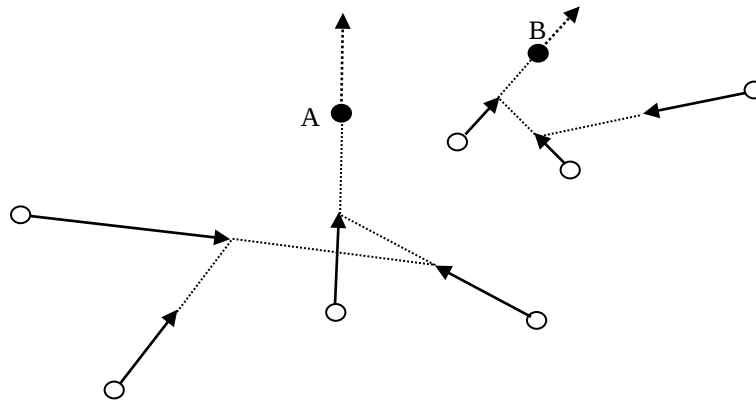


Figure 1) The black beads A and B are confined photons that receive constant impacts from photons of the quantum vacuum (thermodynamic radiation pressure). As the bodies A and B are microscopic, behaviours seem chaotic and unpredictable.

Let's suppose now (see Figure 1) that we put them in a space where there is almost an innumerable quantity of beads of the same size as the beads A and B. However, there is space between the balls. They are in motion and sometimes collide. They hit our beads A and B from all directions. Our beads A and B are then animated of disorderly movements, the fruit of random shocks they experience.

In such a situation, it would be interesting to predict the exact behavior of the beads, but to do so, we would have to take into account a considerable set of initial factors. It is simply impossible to do it. Only statistics can handle this kind of problem.

3.2. The Behavior of Two Macroscopic Bodies

Unlike the previous situation, we will consider here macroscopic bodies, is to say sufficiently large masses so that they are capable of averaging the impacts they receive without moving from their initial position or relative considered to an observer at rest.

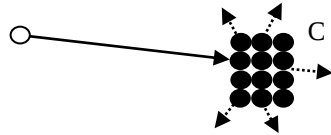


Figure 2) In the cluster C (represented by black beads grouped but free to move), the impact of a single energetic photon (empty bead) on the cluster would result in the fragmentation of the beads cluster in all directions, thus providing individual moves from low speed to all the beads, such as the breakage in a billiard game.

Let's now continue our reflection by putting a multitude of beads near each other to create two clusters which we call C and D. Let's note that no force holds the beads in each cluster (as seen in Figure 2 which shows only the cluster C). However, there are enough beads in each cluster so that the impact of a ball from the space around can be absorbed, at least partially (see Figure 2). Because of the law on the conservation of momentum, the clash between the beads from space and one of the clusters will result in a slow movement of all of the affected clusters. But, as there is a plurality of beads moving in the space around, there is statistically a chance that other impacts occur on the other side of the cluster, which will counterbalance the amount of momentum transmitted previously.

If the universe containing all the beads is sufficiently homogeneous, each cluster will remain consolidated by the "pressure" exerted by the shock of the beads from the outside (see Figure 3). We will call this pressure a "thermodynamic radiation pressure". It consists only of electromagnetic waves.

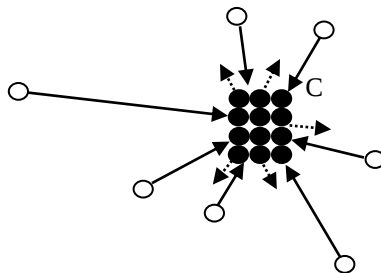


Figure 3) When the cluster C is in a vacuum, it is subjected to a burst of photons from all directions. Even if only one impact (as in Figure 2) would soon have scattered the beads of the cluster, here, the beads are held together by all the impacts from all sides and which counterbalance by statistically meaningful impacts. The cluster vibrates, but its center of mass does not move with respect to an external observer.

Both scenarios (behavior of microscopic and macroscopic bodies) that we analyzed react differently. For beads A and B, the individual movements of the beads appeared to be random. But this is not the case for clusters C and D (see Figure 4). Indeed, the mass of each cluster being larger, the impacts coming from the different directions tend to statistically average out. So, clusters tend to do not have disorderly movements. But a new phenomenon occurs. If the clusters C and D are sufficiently close to each other, they will tend to block the path of certain beads from outside.

For example, a bead from space normally would have hit the cluster D (see Figure 4). But on its way, it meets the beads cluster C. Similarly, a ball that would normally hit the cluster C encounter on its way the beads cluster D. It, therefore, creates, over time, a deficit of percussion in the axis linking clusters C and D. This deficiency is even greater if we move closer the agglomerations C and D together. This thermodynamic radiation pressure deficit causes uncompensated impacts suffered by clusters C and D resulting in the increase of the momentum over time along the axis between them. Clusters C and D appear to be "attracted" to each other. An external observer who does not see the microscopic beads traveling through space around the clusters simply will feel that the cluster C is accelerated towards the cluster D and vice versa. From there, the concept of force. According to the concept of force, the product of mass and acceleration is equal to the force experienced. The observer only observes the result: there seems to be an attraction between the agglomerates. He does not see that the clusters are pushed one over the other.

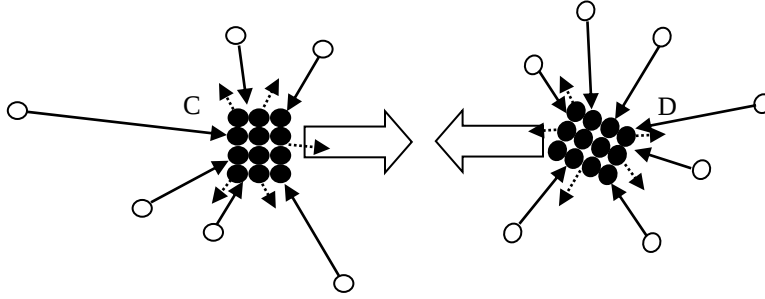


Figure 4) When two clusters C and D are brought into the presence of each other, it creates a quantum vacuum (no photons) between the centers of mass of these. The clusters are thus pushed on each other due to the thermodynamic radiation pressure from the photons of vacuum. From the outside, an observer that would not see the photons of space would be inclined to think that both clusters are attracted towards each other by a "gravitational force".

We mentioned previously that the fact that all the beads (photons) are of the same size was important. Indeed, whatever the wavelength of the photons is, the "bead" which models it has the radius of the Planck length. If a bead were bigger than another, it would more likely to be hit. As all the beads of our model are the same size, they all have the same chance of being hit by the beads from the surrounding space.

3.3. Calculation of the Potential Energy Between Two Macroscopic Bodies

To help to simplify the model (see Figure 5) that we seek to explain, let's assume that our masses are of macroscopic type even if the specific case that is drawn does not have a lot of balls and should normally be treated as a microscopic body. This is just a simple example that serves to facilitate understanding. Then, let's suppose that in the cluster C, there are only $n_1 = 2$ beads (called C_1 and C_2) and that in the cluster D, there are $n_2 = 3$ beads (named D_1 , D_2 , and D_3). There are then 6 lines ($n_1 \times n_2 = 2 \times 3 = 6$) that we can draw from the following bead: C_1 and D_1 , C_1 and D_2 , C_1 and D_3 , C_2 , D_1 , C_2 and D_2 , C_2 and D_3 .

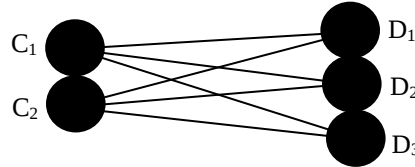


Figure 5) These are the six lines that we can trace between the beads of the agglomerates C and D. These lines represent quantum vacuums (no photons). Using another language, they represent the number of gravitons (virtual photons representing the photon deficit).

Assuming that the beads are made of confined photons, we understand that the number of photons required to constitute the mass of objects in relation is negligible compared to the number N of photons constituting the total apparent mass of the universe. The number N is so large that, whatever the mass of objects in relation is, there will still be approximately N photons in the universe that will be free to participate in collisions.

Let's try to calculate the energy associated with the photons deficit that exists between the clusters C and D. We associate this deficit to virtual photons. Some give the name of "gravitons" to these virtual photons. In our model, it is clear that gravitons simply do not exist. They represent only the deficit of photons that exists between the different cluster masses. From our point of view, it is inconceivable that an object can emit gravitons that would be real photons since the objects would eventually melt and see their energy being reduced over time. Moreover, it is ridiculous that a real particle that would hit other objects could have the effect of making them coming closer together. Conversely, if we launch the beads on an object, it forces it to move away under the impact of the beads that we launch on it. The concept of graviton as a real particle is nonsense. It is rather, as we claim it, a virtual photon representing a particle deficit.

The only photons that can come into resonance between the clusters A and B are those that will have a wavelength equal to 2π times the distance r between the center of mass of the cluster C and the center of mass of the cluster D.

The energy E_{ph} of each of these photons will be:

$$E_{ph} = \frac{h \cdot c}{2 \cdot \pi \cdot r} \quad (3)$$

According to the CODATA 2010 [6], the value of the Planck constant is about $h \approx 6.62606957(29) \times 10^{-34}$ J·s

These photons are trying to push the clusters by their repeated impacts between them. However, the other side of the clusters, the rest of the universe pushes both clusters together with N photons. The resulting potential energy E between the two clusters will necessarily be a portion of E_{ph} :

$$E = \frac{h \cdot c}{2 \cdot \pi \cdot r} \cdot \frac{n_1 \cdot n_2}{N} \quad (4)$$

The number N represents the maximum number of $2\pi R_u$ wavelength photons that it is possible to see in the universe [13]. According to our calculations [9], this number is approximately $6.30341951(12) \times 10^{121}$. Dirac had foreseen this number, realizing that the reports of certain physical characteristics of the same units always gave some numbers [10]. They all stem from the same number on which is applied a different fractional exponent.

If we make the concept of force existing to explain a work, the binding energy between two bodies can be seen as the product of the force F on the distance r :

$$E = F \cdot r = \frac{h \cdot c}{2 \cdot \pi \cdot r} \cdot \frac{n_1 \cdot n_2}{N} \quad (5)$$

Isolating the force F , we obtain:

$$F = \frac{h \cdot c}{2 \cdot \pi \cdot r^2} \cdot \frac{n_1 \cdot n_2}{N} \quad (6)$$

In previous works [9], we have specifically evaluated the value of N :

$$N = \frac{m_u}{m_{ph}} = \frac{R_u^2}{L_p^2} = \frac{1}{\alpha^{57}} \approx 6,30341951(12) \times 10^{121} \quad (7)$$

Here, m_u is the apparent mass of the universe and m_{ph} is the mass associated with a $2\pi R_u$ wavelength photon. Moreover, R_u is the apparent radius of the curvature of the universe and L_p is the Planck length. According to CODATA 2010 [6], the Planck length $L_p \approx 1.616199(97) \times 10^{-35}$ m. According to our work [11], that number is more around $L_p \approx 1.616125436(53) \times 10^{-35}$ m.

Using equation (7) in the equation (6), we obtain:

$$F = c^2 \cdot R_u \cdot \left(\frac{h}{2 \cdot \pi \cdot R_u \cdot c} \right) \cdot \frac{n_1 \cdot n_2}{r^2} \cdot \frac{m_{ph}}{m_u} \quad (8)$$

The mass m_{ph} associated with a $2\pi R_u$ wavelength photons (apparent circumference of the universe) is as follows:

$$m_{ph} = \frac{h}{2 \cdot \pi \cdot R_u \cdot c} \quad (9)$$

According to our researches [1], the apparent radius of curvature of the universe is:

$$R_u = \frac{c}{H_0} = \frac{r_e}{\beta \cdot \alpha^{19}} = \frac{1}{4\pi \cdot \alpha^{16} \cdot \beta \cdot R_\infty} \approx 1.283107880(68) \times 10^{26} \text{ m} \quad (10)$$

This result is confirmed by others [2,3,17]. In the CODATA 2010 [6], we find the following values:

- The speed of light in vacuum $c \approx 299792458 \text{ m}$
- The classic radius of the electron $r_e \approx 2.8179403267(27) \times 10^{-15} \text{ m}$
- The fine structure constant $\alpha \approx 7.2973525698(24) \times 10^{-3}$
- The Rydberg constant $R_\infty \approx 10973731.568539(55) \text{ m}^{-1}$

The value of β is an irrational number. It expresses the ratio between the speed of expansion of the material universe and the speed of light in vacuum c [7]:

$$\beta = 3 - \sqrt{5} \approx 0.76 \quad (11)$$

The inverse of the Hubble constant [12] represents the apparent age of the universe [16].

The measurement of the Hubble constant H_0 is not very clear now. According to Xiaofen Wang [8] and his team, the value of the Hubble constant would be about $H_0 \approx 72,1 \pm 0,9 \text{ km/(s·MParsec)}$. By cons, according to our research [9], it is:

$$H_0 = \frac{c \cdot \alpha^{19} \cdot \beta}{r_e} \approx 72,0954863(46) \text{ km/(s·MParsec)} \quad (12)$$

Using equation (9), equation (8) becomes:

$$F = \frac{c^2 \cdot R_u}{m_u} \cdot \frac{\left(m_{ph} \cdot n_1 \right) \cdot \left(m_{ph} \cdot n_2 \right)}{r^2} \quad (13)$$

When we determined the number of photons that made up the clusters C and D, we split the masses m_1 and m_2 by the rest mass that we can associate to the energy of a $2\pi \cdot R_u$ wavelength photon (apparent circumference of the universe):

$$n_1 = \frac{m_1}{m_{ph}} \quad \text{and} \quad n_2 = \frac{m_2}{m_{ph}} \quad (14)$$

This statement is true in the case where the masses m_1 and m_2 are stationary with respect to a stationary observer. However, in the case where the masses are moving, the respective energy levels would be higher. Indeed, a moving mass sees its level of energy increases due to the addition of photons. The numbers of photons n_1 and n_2 would, therefore, be higher.

For the simple case of static masses or moving to relatively slow speeds with respect to the speed of light, the equation (13) can be rewritten using the equations (14):

$$F = \frac{c^2 \cdot R_u}{m_u} \cdot \frac{m_1 \cdot m_2}{r^2} \quad (15)$$

The apparent radius of the universe is given by the ratio of the current speed of light c in a vacuum and the Hubble constant H_0 :

$$R_u = \frac{c}{H_0} \quad (16)$$

Using equation (16) in equation (15), we obtain:

$$F = \frac{c^3}{m_u \cdot H_0} \cdot \frac{m_1 \cdot m_2}{r^2} \quad (17)$$

The apparent mass of the universe is given by the following equation [4,5] :

$$m_u = \frac{c^3}{G \cdot H_0} \quad (18)$$

In this equation, G is the universal gravitational constant of Newton (taken over by Einstein in his equations of the general relativity). Using the equation (18) we can rewrite the equation (17) like this:

$$F = \frac{G \cdot m_1 \cdot m_2}{r^2} \quad (19)$$

This equation is that of universal gravitation of Newton. Newton's equation is the result of a statistical average of photon impacts on macroscopic type masses. Moreover, it can be shown that Newton's gravitation equation can be obtained using the Poisson statistical equation.

Since the impacts of the photons could not be adequately compensated on the "microscopic" masses, Newton's equation can not describe the behavior of these latter. Only the behavior of macroscopic masses at low speed can be described using this equation.

4. DARK ENERGY

No one could prove its existence and many suspect that there is a form of energy that would not be visible by traditional methods, the "dark energy". According to NASA, it would compose 73% of our universe.

As we mentioned, the vacuum of our universe is a bath filled with photons of different wavelengths. We believe that dark energy would be composed of photons whose wavelengths are such that we cannot measure them. Indeed, to make it possible to detect an electromagnetic wave, it is necessary to build an antenna having the size of about a quarter of wavelength. We are more or less confined to the Earth and the dimensions allowed to build large-sized antennas are rather limited compared to the range of wavelengths that it would be interesting to catch. Although we were allowed to make an antenna the size of our galaxy, there would be a wide range of wavelengths missing. Similarly, in the infinitely small, we are blind for a very wide range of wavelengths. We should know that the full range, from the infinitely small to the infinitely large, stretches from the Planck circumference that is $2\pi L_p$ up to the apparent circumference of our universe that is $2\pi R_u$.

Since we are not able to measure all wavelengths, we can still use the theory ...

4.1. Gravitational Interaction Speed

Let's make an experience. Let's take an object and let's position it in space. Let's suppose that we are a great magician and that we can instantly make appear an object in space near the first object. How the two objects will let "know" to the other their position and their presence? Without having more than Newton's equation, this phenomenon might seem instantaneous. By using our new knowledge of gravitation, we know that the gravitational force does not exist and

is the fruit of a photon radiation pressure. Therefore, the transmission in the vacuum of the "gravitational force" is the speed of light.

5. CONCLUSION

As our model leads to the equation of the universal gravitation of Newton, we conclude that it can be used to better understand the phenomenon of gravitation. Although the resulting equation of our model is not as accurate as of that of general relativity, our model has the advantage of being a simple explanation to understand and to express it mathematically.

Classical Newton's mechanics theory does not attempt to give any explanation of the root cause of gravitation. Einstein, with his theory of the general relativity, explained gravitation by a change in the geometry of space in the presence of energy (mass). However, this explanation does not say how the masses make vary the geometry of space. It only quantifies it.

We believe that it will be possible soon to explain the concepts of nuclear forces by using a development of the same model that was used to explain the concept of gravitational and electrostatic forces [18].

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