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The Generalization of Gravitational Theory and Its Explanation to the Two Dark Phenomenon

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Abstract

In this paper, a new theory of gravity is proposed, which extends Newton's theory of gravity. This paper discusses the law of gravity and the basic physical properties in the three-dimensional hypersphere space, including the antigravity field, the distribution law of galaxies and the accelerated expansion of space. It is pointed out that the discovery of "accelerating expansion of the universe" proves that the universe is approximately a three-dimensional hypersphere space on the whole. It is revealed that dark matter and dark energy are caused by a common cause, which is the result of the generalized gravitational field in the universe. Finally, a life cycle of the future evolution of the universe is discussed.

Keywords

Dark matter; Dark energy; Gravitational theory; Three-dimensional hypersphere space; Antigravity field; Accelerating universe.

1. INTRODUCTION

In modern cosmology, dark matter and dark energy [1] ("two dark" for short) are the biggest unsolved mysteries. The two dark concepts were proposed to explain the gravitational excess of galaxies (or galaxy clusters) and the accelerating expansion of the universe. From the role played by the two darkness, it should be a very important thing that exists universally in the universe. However, a large number of experiments and astronomical observations have shown that the existence of the two dark bodies is almost imperceptible, except for affecting the motion mode of other substances. For decades, all attempts to detect dark matter particles have failed. This reinforces the belief that the two dark concepts are likely to be similar to the "ether" [2] in the history of physics , and will be abandoned when the basic theories of physics are further developed. According to the above ideas, this paper generalizes Newton's theory of gravity on the basis of previous physical theories, so that the two dark problems can be solved naturally.

2. PRINCIPLE OF GENERALIZED GRAVITATIONAL FIELD

2.1. Basic Postulate of Gravitational Field

Following the practice in electromagnetics, we regard the gravitational field as composed of a large number of gravitational lines. The direction of the gravitational line represents the direction of the gravitational field, and the density of the gravitational line distribution represents the strength of the gravitational field. If the number of gravitational lines passing in a certain direction is called the gravitational field flux, then the gravitational field intensity can be defined as the gravitational field flux per unit area perpendicular to the direction of the gravitational line, namely the gravitational field flux density. It can be expressed as

$$g = \frac{d\phi}{dS_\perp}. \tag{1}$$

Here, g is the strength of the gravitational field, ϕ is the flux of the gravitational field, and $S_\perp$ is the area perpendicular to the direction of the gravitational line. [3] Here, we propose a basic hypothesis about the gravitational field, which is called the "basic postulate of gravitational field". It is expressed as: the total amount of gravitational lines in the gravitational field of any object is in direct proportion to the mass of the object. The scale coefficient is a constant independent of the properties of the object, which is called the "fundamental constant of gravity". It can be expressed as

$$\phi = -\kappa m. \tag{2}$$

Here, m is the mass of the object, κ is the fundamental constant of gravity, and "$-$" indicates that the direction of the gravitational line is opposite to the position vector.

2.2. Gravitational theory in Euclidean space

We assume that in an infinitely extensive three-dimensional Euclidean ("three-E" for short, and "four-E" in a similar sense) space, all gravitational lines of an arbitrary particle M extend infinitely from the particle to all directions around it along a straight line. At this time, the gravitational lines are spherically symmetrical with respect to the particle M, the flux density of the gravitational field is the same on each sphere with the particle M as the center of the sphere r as the radius. According to the basic postulate of the gravitational field, it is easy to get the gravitational law in the three-E space as

$$F_y = mg = -\frac{\kappa}{4\pi}\frac{Mm}{r^2}. \tag{3}$$

It is completely equivalent to Newton's law of gravity [4]

$$F_y = -G\frac{Mm}{r^2}.$$

By comparing the above two equations, we can get

$$G = \frac{\kappa}{4\pi}. \tag{4}$$

Therefore, Newton's gravitational constant G is not a basic constant, but a combination constant. In physics, the basic constants related to gravity should be κ, $\kappa = 4\pi G \approx 8.38501\times10^{-10}\ N\cdot m^2/kg^2$.

The gravitational field equation corresponding to the gravitational law in the three-E space is

$$\nabla^2\varphi = \kappa\rho. \tag{5}$$

Here,

$$\nabla^2 = div\ grad = \sum_{\alpha=1}^{3} \frac{\partial^2}{\partial x_\alpha^2}$$

is the Laplace operator under Descartes coordinates in the three-E space, $\varphi = \varphi(x_1, x_2, x_3)$ is the gravitational potential ($g = -grad\ \varphi$), and $\rho = \rho(x_1, x_2, x_3)$ is the density of matter in the three-E space. [5] Equation (5) is equivalent to Newton's gravitational field equation

$$\nabla^2 \varphi = 4\pi G \rho .$$

Comparing the two equations, it is easy to see that the gravitational field equation expressed by the basic constant of gravity κ is more concise in mathematical structure.

2.3. Principle of Generalized Gravitational Field

Because Newton's theory of gravity is based on a large number of physical experiments and astronomical observations, it is an empirical law. But we can deduce the same conclusion theoretically from the basic physical hypothesis, and it is hard to believe that this is just a coincidence. Therefore, the assumption we made on the distribution law of gravitational field in Euclidean space in the previous section should reflect something substantial about the gravitational field. We take this hypothesis as a basic principle in physics, which is called "the principle of narrow gravitational field". It is expressed as: all gravitational lines of any object are distributed along a straight line in Euclidean space, and there is no overlap throughout the space. Among them, "no overlap" means that any space point around an object can only be passed by the gravitational line emitted by the object for a single time. Because there are more general spatial structures than Euclidean space in geometry, such as curved Riemannian space [6], Euclidean space is only the limit case of Riemannian space in an infinite small area. Therefore, the distribution law of gravitational field in Euclidean space is not a general law of gravitational field. Therefore, we should generalize the above gravitational field principle and call it "generalized gravitational field principle". It is expressed as: all the gravitational lines of any object are distributed along the geodesic in the space of any structural form, and there is no overlap throughout the space. According to the generalized gravitational field principle, the gravitational field in any space is not only generated by the matter in the local space as the gravitational source, but also depends on the geometric structure of the outer space where the matter is located. The "outer space" of an object refers to the specific space after the influence of the object's gravitational field is eliminated. In Euclidean space, the outer space of any object remains unchanged before and after the object is translated, which is not the case in general Riemannian space. In short, according to the idea of the generalized gravitational field principle, the same object placed in the space of different geometric structures will produce different forms of gravitational fields.

3. DEDUCTION OF THE PRINCIPLE OF GENERALIZED GRAVITATIONAL FIELD

3.1. Gravitational Theory in Riemannian Space

In the general three-dimensional Riemannian ("three-R" for short, and "four-R" in a similar sense) space, the law of gravity does not follow the inverse square law as Newton's law of gravity does. As we know, the overall geometric structure of curved space has three basic forms: flat space, hyperbolic space and elliptical space. Among them, the flat space is infinite, and the curvature is zero; hyperbolic space is also infinite, with curvature less than zero; elliptical space is finite and curvature is greater than zero. [7] According to the generalized gravitational field principle, all gravitational lines of particles in any structure space are distributed along geodesic, and the strength of gravitational field is equal to the density of gravitational line distribution.

Therefore, the attenuation of the gravitational field strength is faster than the inverse square law in hyperbolic space and slower than the inverse square law in elliptical space as the distance from the particle increases. According to the geometry in different spaces mentioned above, we can deduce the specific form of the law of gravity. As a typical example, we will give the law of gravity in the three-dimensional constant curvature elliptic space, namely, the three-dimensional hypersphere [8] ("three-H" for short) space.

In order to facilitate understanding, we first discuss the law of gravity in two-dimensional constant curvature elliptic space, namely, two-dimensional spherical space. Let's suppose that there is a spherical with a center of O and a radius of R in a three-E space, and there are two particles M and m at two points A and B in spherical respectively. According to the geometry of the spherical, it is easy to obtain that the law of gravity in spherical space is

$$F_y = -\frac{\kappa}{2\pi}\frac{\frac{r\pi}{L}}{\sin\left(\frac{r\pi}{L}\right)}\frac{Mm}{r}. \tag{6}$$

Here, L is the scale of the spherical space (That is, 1/2 of the largest circumference in the spherical), and r is the geodesic length in the spherical. Similar to the case in the spherical above, we assume that there is a three-H space with a center of O and a radius of R in a four-E space, and there are two particles M and m at two points A and B in the three-H space respectively. By comparing with spherical space, it is not difficult to find out that the law of gravity in the three-H spaces is

$$F_y = -\frac{\kappa}{4\pi}\left[\frac{\frac{r\pi}{L}}{\sin\left(\frac{r\pi}{L}\right)}\right]^2\frac{Mm}{r^2}. \tag{7}$$

Here, L is the scale of the three-H spaces, and r is the geodesic length in the three-H spaces. When r 3 L, namely, $r/L \to 0$, the above equation can be transferred to equation (3). Therefore, Newton's law of gravity is the limit case of the law of gravity in the three-H spaces.

We extend the gravitational field equation in the three-E space to the three-R space as

$$\nabla^2\varphi = \kappa\rho. \tag{8}$$

Here,

$$\nabla^2 = \frac{1}{\sqrt{g}}\sum_{\alpha=1,\beta=1}^{3}\left[\frac{\partial}{\partial x_\alpha}\left(g^{\alpha\beta}\sqrt{g}\,\frac{\partial}{\partial x_\beta}\right)\right]$$

is the Laplace operator [9] in the Gauss coordinate in the three-R space, and $\rho = \rho(x_1, x_2, x_3)$ is the density of matter in the three-R space. As a special case, any infinitesimal small area in a three-R space can be regarded as a three-E space. At this time, the metric tensor [10] of the three-R space is

$$g_{\alpha\beta}=\eta_{\alpha\beta}=\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix},$$

and equation (8) can be transferred to equation (5). Therefore, Newton's gravitational field equation is the limit case of the gravitational field equation in the three-R space.

3.2. Combined Gravitational Field of Material System

According to the concept of general relativity, the gravitational field is essentially a curved four-R space-time [11], and each gravitational field corresponds to a space-time metric tensor field. We assume that there is a matter system composed of matter element $1,2,3,\ldots,n$ in the three-E space, and the density of each matter element in the system is $\rho_i(i=1,2,3,\ldots,n)$. According to the generalized gravitational field principle, the gravitational potential φ_i generated by each material element in the above material system is not only related to the density ρ_i of the material element, but also depends on the geometric structure form of the external space where it is located — that is, the three-dimensional metric tensor $g^{\alpha\beta}$ corresponding to the gravitational potential generated by all material elements in the system is relative to the specific distribution $g^{\alpha\beta}{}_i$ of the material element. Therefore, the gravitational field equation satisfied by the gravitational potential φ_i generated by each material element in the system is

$$\frac{1}{\sqrt{g}}\sum_{\alpha=1,\beta=1}^{3}\left[\frac{\partial}{\partial x_\alpha}\left(g^{\alpha\beta}{}_i\sqrt{g}\frac{\partial\varphi_i}{\partial x_\beta}\right)\right]=\kappa\rho\ . \tag{9}$$

The combined gravitational field of the material system is

$$\varphi=\sum_{i=1}^{n}\varphi_i\ . \tag{10}$$

The above results show that the combined gravitational field of the material system is not simply the sum of the gravitational fields generated when each particle exists in isolation. Because the outer space of each particle in the system is a three-R space with positive curvature, the strength of the gravitational field at the same distance from the particle increases compared with the three-E space. Therefore, the gravitational field generated by each particle in the material system is greater than the result when it exists in isolation. Therefore, the combined gravitational field of the material system is greater than the sum of the gravitational fields generated when each particle exists in isolation. According to this conclusion, when the scale of the material system is large enough (such as galaxies or galaxy clusters), the deviation of its combined gravitational field from the inverse square law will reach an observable degree, and as a result, the attenuation of the gravitational field strength along with the distance will become more slow.

3.3. Properties of Spherically Symmetric Gravitational Field

In general relativity and Newtonian gravity theory, the gravitational field of spherically symmetric matter distribution has a common property, that is, the gravitational field outside the sphere only depends on the total mass of the gravitational source, but is independent of the size of the gravitational source and the distribution of the density of matter with radius. As it is said in the Birkhoff theorem, if the spherically symmetric gravitational source is not at rest but in radial motion, and maintains spherically symmetric in motion (such as expansion, contraction or radial oscillation), its external gravitational field can still be described by Schwarzschild's solution. [12] Due to the above reasons, the information related to the distribution and motion of matter in the gravitational source cannot be obtained by observing the spherically symmetric gravitational field.

According to the conclusion of this paper, this is not the case. Because according to the generalized gravitational field principle, the external gravitational field φ_i generated by each material element in the material system as a gravitational source is not only related to the mass of the material element, but also depends on the geometric structure form ${g^{\alpha\beta}}_i$ of the external space where it is located. It satisfies the gravitational field equation

$$\frac{1}{\sqrt{g}}\sum_{\alpha=1,\beta=1}^{3}\left[\frac{\partial}{\partial x_\alpha}\left({g^{\alpha\beta}}_i\sqrt{g}\,\frac{\partial\varphi_i}{\partial x_\beta}\right)\right]=0\,. \tag{11}$$

And ${g^{\alpha\beta}}_i$ changes with the change of the spatial distribution of matter in the system. Therefore, the resultant gravitational field generated by the gravitational source is directly related to the size of the gravitational source and the distribution of the density of matter with radius.

What is discussed above is the case of a stationary matter system. For a general spherically symmetric matter system whose volume and density change with time according to the radius distribution, the spatial distribution of its resultant gravitational field also changes with time. Therefore, theoretically, the information related to the distribution and motion of matter in the gravitational source can be obtained by observing the spherically symmetric gravitational field.

4. BASIC PHYSICAL PROPERTIES IN THREE-H SPACE

4.1. Antigravity Field

It is easy to find that the function image of formula (7) of the law of gravity in three-H paces is symmetric about line $r = L/2$. It can be concluded that the variation law of gravitational field strength with distance r in the three-H spaces is: first, when the neighborhood of particle M ,namely, $r \to 0$, the gravitational field is strongest; second, with the distance from the particle M gradually increasing, the gravitational field strength gradually weakens in the range of $r \in (0, L/2]$, and reaches the limit at $r = L/2$; third, the strength of the gravitational field gradually increases within the range of $r \in [L/2, L)$, and reaches the maximum again when the neighborhood of the antipodal point of the particle M (that is, the point farthest from the particle M in the three-H spaces) is $r \to L$.

We usually call the gravitational field, the direction of all gravitational lines is from the surrounding distance to the center, such as the gravitational field around the particle M. However, around the antipodal point A' of particle M, the direction of all gravitational lines is from the center to the surrounding distance, which is just the opposite of the gravitational field. Therefore, for A', the gravitational field generated by particle M is an antigravity field, and A' is the center of the antigravity field. The strength of the antigravity field is inversely opposite to the gravitational field of corresponding particle M. The antigravity law can be expressed as

$$F_f = -F_y = \frac{\kappa}{4\pi}\left[\frac{\frac{r\pi}{L}}{\sin\left(\frac{r\pi}{L}\right)}\right]^2 \frac{Mm}{r^2}. \tag{12}$$

Here, M is the mass of the object at the antipodal point of the center of the antigravity field. The gravitational field and antigravity field in the three-H spaces are collectively referred to as "generalized gravitational field". The existence of antigravity field is a special property of closed elliptical space which is different from other forms of space. In a flat space or hyperbolic space, the gravitational line from any particle is always divergent with the increase of the distance from the particle, so it is impossible to form an antigravity field.

4.2. The Distribution of Galaxies

According to the law of gravity in the three-H spaces, we assume that there are a large number of stars distributed in the three-H spaces and that the stars have existed long enough to form an antigravity field with the same strength as the star's gravitational field around the antipodal point of each star. At this time, for any space point in the three-H spaces, the gravitational field is from the star direction, while the antigravity field is from the star antipodal point direction. In the three-H spaces where a large number of gravitational fields and antigravity fields coexist, the space position of each star cannot be arbitrary. Their regular motion has the following two ways: first, under the action of the nearby gravitational field, it merges with other stars to form a larger star system (such as galaxies or galaxy clusters); second, it is squeezed into a single space region by multiple antigravity fields from different directions. The relatively stable distribution structure of a large number of stars formed by the combined action of the above two motion modes is that all galaxies and their antigravity field centers are roughly evenly distributed in the entire three-H spaces, in which each galaxy is surrounded by eight antigravity field centers from different directions, and each antigravity field center is also surrounded by eight galaxies from different directions. At this time, in the three-H spaces, the resultant force of anti gravity in all directions around each galaxy is equal to zero. It can be expressed as

$$\sum_{i=1}^{8} F_{fi} = 0. \tag{13}$$

Here, $F_{fi}\left(i=1,2,3,\ldots,8\right)$ is the anti gravity in every direction around the galaxy. Here, we explain the origin of the number "eight" above: in circular space, each galaxy is surrounded by two antigravity field centers in different directions; in spherical space, each galaxy is surrounded by four antigravity field centers in different directions; by analogy, each galaxy in the three-H spaces should be surrounded by eight antigravity field centers in different directions.

The uniformity of the distribution of all galaxies in the entire three-H spaces is related to the mass difference between the galaxies.

Because the more massive the galaxy is, the stronger the antigravity field is generated, and other galaxies in this antigravity field will be repelled further; on the contrary, the weaker the antigravity field generated by the galaxy with smaller mass, the other galaxies in this antigravity field will be repelled closer. Therefore, if the mass difference between galaxies is smaller, the galaxies will be more evenly distributed; on the contrary, if the mass difference between galaxies is greater, the uniformity of galaxy distribution is worse.

4.3. Accelerated Expansion of Space

The three-H spaces with a large number of galaxies cannot be static.

Because in the three-H spaces where a large number of gravitational fields and antigravity fields coexist, each galaxy is on the one hand subject to the gravitational effects of other galaxies, and on the other hand subject to the antigravity effects of various antigravity fields. However, for each galaxy, since the eight antigravity field centers around it are closer than all other galaxies, the resultant gravity in any direction it receives is antigravity. Therefore, all galaxies in the three-H spaces will accelerate away from each other under the action of the above antigravity. Because the overall geometry of the three-H spaces is determined by the distribution and movement of all the substances in them.

Therefore, the scale of the three-H spaces will increase at the same speed, that is, the expansion of the three-H spaces will accelerate. In the expansion process of the three-H spaces, the newly added space volume is continuously filled by the gravitational lines of each galaxy.

The acceleration of the expansion of the three-H spaces depends on the mass of each galaxy and the scale of the three-H spaces. On the one hand, the greater the mass of each galaxy in the three-H spaces, the stronger the anti gravity field formed, and the greater the gravitational acceleration generated by other galaxies in this anti gravity field. On the other hand, when the total number of galaxies remains unchanged, if the scale of the three-H spaces is smaller, the distance between the galaxies will be closer. At this time, the closer the galaxies are to the center of the antigravity field, the greater the gravitational acceleration generated by the galaxies will be. In addition, the smaller the scale of the three-H spaces, the greater the positive curvature of the space, the stronger the antigravity field formed by each galaxy, and the greater the gravitational acceleration generated by other galaxies in this antigravity field.

If we assume that the gravitational field and antigravity field strengths in a certain direction around any galaxy in the three-H spaces are g_y and g_f respectively, then the resultant gravitational acceleration of the galaxy moving in that direction is

$$g = g_y + g_f \,. \tag{14}$$

If the observer uses any one of the galaxies as the observation point to observe the movement of other galaxies in a certain direction, then the far away acceleration of the galaxy measured by the observer is the algebraic sum of the gravitational acceleration components of all galaxies along the way in that direction. It can be expressed as

$$\begin{aligned} a &= \sum_{i=1}^{n} \left| g_i \right| \\ &= \sum_{i=1}^{n} \left| g_{yi} + g_{fi} \right| \end{aligned} \,. \tag{15}$$

Here, $g_i = g_{yi} + g_{fi} \left(i = 1, 2, 3, \ldots, n \right)$ is the component of gravitational acceleration of each galaxy along the way in the observation direction.

If the mass of all galaxies is roughly evenly distributed in the three-H spaces, then the accelerated expansion of the three-H spaces will also occur roughly evenly in different regions. At this time, for an observer in any galaxy, the acceleration of each galaxy away from the observer is roughly linear with the distance from the galaxy to the observer. It can be expressed as

$$a = \lambda l \, . \tag{16}$$

Here, a is the acceleration of the galaxy away from the observer, l is the distance between the galaxy and the observer, and the scale coefficient λ is a constant independent of the nature of the galaxy.

5. PHYSICAL EXPLANATION OF THE TWO DARK PHENOMENA

In the above article, we discussed the gravitational law and basic physical properties in the three-H spaces on the basis of the generalized gravitational field principle. According to the new gravity theory in this paper, we can make the following explanations for the two dark phenomena in the universe. On the one hand, due to the existence of antigravity field in the three-H spaces, the overall accelerated expansion of space is a unique property of the three-H spaces with a large number of galaxies (or galaxy clusters). Therefore, the discovery of "accelerated expansion of the universe" actually proves that the overall geometry of the universe is three-H spaces. If we consider that the distribution of matter in the universe is not completely uniform, then the universe should be a quasi three-H space more accurately. On the other hand, in the quasi three-H space with a large number of gravitational fields and antigravity fields, the gravitational field around each galaxy cluster is actually a combined gravitational field composed of two parts. One part is the gravitational field generated by the galaxy cluster itself. As a star system, the strength of the combined gravitational field is greater than the sum of gravitational fields generated when each star exists alone, and does not meet the inverse square law. The other part is the antigravity field mainly from the eight antigravity field centers around the galaxy cluster. Since the universe is not a standard three-H space, the center of the antigravity field formed by the intersection of the gravitational lines of each galaxy cluster at its antipodal point may not be a point but a space area. If we use g to represent the strength of the combined gravitational field around any galaxy cluster, g_y to represent the strength of the cluster's own gravitational field, and g_{fi} to represent the strength of each antigravity field around the cluster, then

$$g = g_y + \sum_{i=1}^{8} g_{fi} \, . \tag{17}$$

Moreover, in the quasi three-H cosmic space, since the outer space of each galaxy cluster is a Riemannian space with positive curvature, the attenuation of the gravitational field and antigravity field with distance is slower than the inverse square law. The direction of the combined gravitational field around the cluster is the same as that of the cluster itself, and the intensity of the combined gravitational field at each space point increases to varying degrees on the basis of the cluster's own gravitational field. The space point that is farther from the center of the cluster is closer to the center of the antigravity field, and its gravitational field strength increases more significantly. Due to the existence of the above reasons, the measured strength of the gravitational field around the star cluster in the universe is obviously larger than that calculated according to the general relativity or Newton's gravity theory. Moreover, when the size of the galaxy cluster is larger or the scale of cosmic space is smaller, the above effects become more significant.

To sum up, according to the concept in this paper, the two dark phenomena in the universe are caused by a common cause and are the result of the generalized gravitational field in the quasi three-H cosmic space.

Therefore, dark matter in the form of matter particles may not exist, and dark energy is essentially the antigravity field in cosmic space. By the way, according to the theory in this paper, every big or small cosmic voids should be the region where the center of the antigravity field is located.

Because the antigravity field generated by the celestial bodies with larger mass is stronger, the super cosmic voids with huge diameter should be generated by the supermassive black hole at its antipodal point.

6. DISCUSSION ON THE FUTURE DESTINY OF THE UNIVERSE

I believe that many people will care about the future destiny of the universe. Will the universe always expand? Or will it stop and reverse contract? Now, on the basis of the theory in this paper, we will briefly discuss the above issues.

First, let's simplify the universe. It can be considered that there are only two essential things in the universe: galaxies and gravitational fields in space. According to Einstein's mass energy relation equation [13], gravitational field has energy and therefore mass. Since the gravitational field is composed of gravitational lines, the mass of the gravitational field is equal to the sum of the masses of all gravitational lines in the gravitational field. In the three-H cosmic space, the length of each gravitational line of all galaxies is equal to the scale L of the universe, and the mass of each gravitational line is proportional to the length of the gravitational line. Therefore, the total mass of the gravitational field in the universe can be expressed as

$$m_y = n\rho_y L \,. \tag{18}$$

Here, ρ_y is the mass density of the gravitational line (That is, the mass of a gravitational line of unit length), and n is the total number of gravitational lines in the universe. In a completely closed three-H cosmic space, galaxies and gravitational fields can transform each other under certain conditions, and the total mass is conserved during the transformation. It can be expressed as

$$m_x + m_y = const \,. \tag{19}$$

Here, m_x is the total mass of galaxies in the universe.

Because in the process of accelerating the expansion of the universe, the length of each gravitational line increases with the scale of the universe. If the total number of gravitational lines does not change, then the mass of the gravitational field in the cosmic space will continue to increase, and the increased mass of the gravitational field can only be obtained by the reduction of the mass of the galaxy. But according to the basic postulate of gravitational field, the total number of gravitational lines in the universe should be proportional to the total mass of the galaxy. Assuming that the basic postulate of gravitational field is valid, the total number of gravitational lines will decrease as the mass of the star system in the universe decreases. If the universe keeps expanding, then one day, when the mass of all galaxies decreases to zero, the total number of gravitational lines will also decrease to zero. At that time, the total mass of galaxies and gravitational fields in the universe will become zero, thus violating the law of conservation of mass. Therefore, the assumption in the premise is not valid, and the total number of gravitational lines should not decrease with the decrease of the mass of the galaxy. Therefore, the basic postulate of gravitational field is not true in all cases. Although the fundamental constant of gravity κ is a constant unrelated to the properties of objects, the quantity value of κ may increase gradually with the expansion of space, so that the total number of gravitational rays in the universe remains unchanged. Having made this clear, we will continue to discuss the future fate of the universe. The evolution of the universe can be divided into the following four stages according to the different states of space movement.

First, the accelerating expansion stage of the universe. In the process of accelerating the expansion of the universe, the length of all gravitational lines increases with the scale of the universe, while the total number of gravitational lines remains unchanged. Therefore, the mass of all galaxies in the universe will decrease proportionally, and the mass of galaxies will be converted into the mass of gravitational field. With the continuous expansion of space, galaxies are farther and farther away from the center of the antigravity field, and the acceleration of galaxies away from each other will be smaller and smaller, but always greater than zero. Until the mass of almost all galaxies decreases to zero, the universe expands to the limit state. At this time, the mass of galaxies in the universe is almost completely transformed into the mass of gravitational field.

Second, the accelerating contraction stage of the universe. At the end of the first stage and in the fully evolved space, there are neither galaxies, nor gravitational field and antigravity field centers. It is almost a uniformly distributed network composed of gravitational lines. At this time, the universe is unstable and will not exist for a long time. Gravitational fields have their own mass, so there is gravitational action between them. Under the action of gravity, the gravitational fields begin to draw closer to each other, and the scale of the universe also gradually decreases. Since then, the universe has entered the accelerated contraction stage. Due to the large scale of space, the gravitational effect between gravitational fields is very small. Therefore, the early stage of the accelerated contraction of the universe is a rather slow process. However, as the scale of the universe becomes smaller and smaller, the contraction of the gravitational field becomes more and more intense, and the temperature in the universe becomes higher and higher, until various basic particles are produced. The universe in this period is a process of transforming gravitational field into ordinary matter. Since then, the space has continued to shrink until it finally shrinks to the limit state, when a huge cosmic explosion occurred.

Third, the explosion stage of the universe. A new universe was born from the Big Bang. In the early stage after the birth of the universe, the huge energy of the Big Bang drove the expansion of the universe in an exponential form(That is, the explosion of the universe). With the explosion of cosmic space, the residual energy of the Big Bang decreases rapidly.

Fourth, the decelerate expansion of the universe to the accelerated expansion stage. When the residual energy of the Big Bang is reduced to the point where the gravitational action between materials can compete with it, the universe begins to enter the decelerate expansion stage. For a long time since the Big Bang, the matter in the space has been almost uniformly distributed. The uniformly distributed matter will produce a uniformly distributed gravitational field, and it will not change until stars or galaxies are produced in cosmic space. When stars and galaxies gradually formed, the matter in cosmic space began to become uneven. However, for a period after that, the expansion of space was still decelerating. Because the change of gravitational field propagates at the speed of light, it will take a long time for the gravitational line of each galaxy after recombination to reach the other end of the three-H cosmic space (that is, the antipodal point of the galaxy) to form an antigravity field. After the formation of the antigravity field in the universe, the galaxies began to accelerate away from each other under the action of antigravity. Since then, the cosmic space has entered the stage of accelerated expansion, until now we have observed the scene.

The above is a life cycle of the future evolution of the universe predicted according to the theory in this paper. The end of one life cycle of the universe is the beginning of the next life cycle. In this way, the cycle is endless. Therefore, the three-H cosmic space may be evolving in a pulsating way. As a whole, time in the universe is infinitely long. There is neither a starting point nor an end point. From this point of view, the universe is a self-sufficient system and does not need God as the first driver.

7. CONCLUSION

This paper is first a new theory of gravity, not just a solution to the two dark problem. This theory can explain the two dark phenomenon to a certain extent, which can be seen as one of its applications and is superior to previous physical theories. The starting point (or premise) of this theory is very simple. There is only one postulate and one principle (namely, basic postulate of gravitational field and generalized gravitational field principle). As an axiomatic physics theory, all the conclusions in this paper are derived from the premise through deduction.

Therefore, if the premise of the theory is correct, then the conclusions in the paper will generally not appear principled errors. Although the theory in this paper has promoted Newton's theory of gravity, there are still obvious shortcomings. Because a perfect gravitational theory must be a theory of deformed space-time expressed in geometric language. In addition, there is still a lot of specific work to be done on the final solution of the two dark problem. I hope that physicists in related fields can work together to study it.

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Due to my limited level of knowledge, there are inevitably shortcomings in the article. I sincerely hope that all the physics experts and scholars can criticize and correct me. I am deeply grateful for this!

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