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An interesting model of gravitational field

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Abstract:

According to the particle model in the Theory of system relativity, a new model of gravitational field is constructed, and the gravitational field is composed of a stationary attractive region and a stationary repulsive region. On this basis, the covariant motion equation and the equation of the speed of light are proposed, and the new explanations of some observations are given and some traditional views are questioned.

Keywords: Model of gravitational field, Field-domain, Critical field, Stationary attractive region, Stationary repulsive region, Covariant motion equation, Equation of the speed of light.

1. Introduction

In general relativity, the gravitational field are manifestations of the curved time and space. Namely, curved time and space is the source of gravitational force. In other words, there is a correlation between the gravitational fields and the geometric of space. In the Theory of System Relativity[1], the ambient environment of the Earth (or a celestial body) is full of shuon fluid [2] (historically called the ether), the geometric properties of the shuon fluid are described by the space. There are space-density contours in the form of a series of concentric circles centered on the Earth, rather than a bending of space; The dynamic properties of the shuon fluid around the Earth are described by the gravitational field, and the gravitational field and an object field will become coupled to generate an attractive force. Therefore, we can see that A. Einstein used the geometric properties of the shuon fluid to describe its dynamic properties.

2. The formation principle of gravitational field

In the Theory of System Relativity, the gravitational field of an object (celestial body) is a neutral field and originates from the fields of the particles that constitute the object. These particle fields are all composite fields that consist of neutral fields and polar fields. Apparently, the polar fields of the particles are shielded inside the object. In the following, we first discuss the screening mechanism of an object on its interior polar field.

2.1. Structural features of polar fields and neutral fields

The electron is a typical particle that possesses both a polar field and a neutral field. Every vortex ring in the polar field is attached to a certain photon[3] in the electron's outermost layer. In particular, the vortex rings of the same photon that have different curvatures are clustered together, and the shapes of vortex rings with larger radii of curvature are closer to perfect circles.

In the neutral field of the electron, each vortex ring is connected to one pair of adjacent photons in the electron. The vortex rings are symmetrically distributed on the two side faces of the electron, and the coupled vortex rings between adjacent photons exhibit radiating structures on the two ends.

2.2. Coupling features of polar fields and neutral fields

Usually, vortex-tube coupling occurs between the neutral field of one particle and the neutral field of an adjacent particle. In other words, the coupling of vortex tubes between particles in an object occurs either between their polar fields and or between their neutral fields.

The coupling of vortex tubes between the polar fields of particles in an object takes two forms, namely, **parallel coupling** and **series coupling**. For parallel coupling, when two particles are coupled, the coupled polar field between them converges to the internal field of the system consisting of the two particles, and this is called the **converging property** of a parallel-coupled polar field; for series coupling, when two particles are coupled, the attenuation step size(namely, the radius of coupling particle) of the field strength increases. The radiation distance of the coupled polar field between the particles is larger; this is called the **extension property** (or **additivity**) of a series-coupled polar field.

The series coupling of polar fields often occurs between the surface particles of an object. An electrostatic field is formed when the series coupling of the polar fields of particles on the surface of the object extends to surround the object. The parallel coupling of polar fields often occurs between particles inside the object, which causes a vast accumulation of polar vortex flux inside the object.

In the case of the vortex-tube coupling between neutral fields of particles in the object, there is no parallel coupling; there is only series coupling, as shown in Figure 1. After two particles become coupled, their external neutral field strength increases, and the radiation distance also increases; this is called the extension property of a coupled neutral field. The extension property of neutral fields prevents the shielding of the gravitational field.

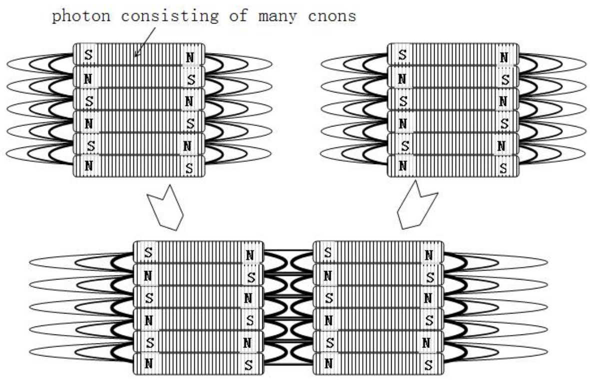

Figure 1 Extension of coupled vortex rings between neutral fields

2.3. The formation principle of an object's gravitational field

According to the aforementioned converging property of polar fields, the polar vortex fluxes of particles inside an object all converge inside the object, and only the coupled polar vortex flux between surface particles radiates outward, as shown in Figure 2. Apparently, this portion of the polar vortex flux radiating outside the object accounts for only a very small proportion of the total polar vortex flux of the object. A large number of photons and electrons in the critical field are coupled in series to this portion of the polar vortex flux, meaning that this portion of the polar vortex flux is nearly exhausted at a very short distance from the surface. This is why the critical field strength is highly nonlinear. as shown in Figure 3b.

According to the extension property of neutral fields, the neutral vortex flux in an object continues to grow by means of the continuous coupling and extension of the neutral vortex flux between particles. When it reaches the surface of the object, the neutral vortex flux reaches a maximum.

From the interior of the critical field to the exterior, the polar field strength rapidly decays at an attenuation step size corresponding to the distance d between the surface particles, and field domain simultaneously converges; at the same time, the neutral field domain rapidly expands, and the field strength correspondingly attenuates. As shown in Figure 2, along with the continuous contraction of the polar field domain and the continuous expansion of the neutral field domain, the critical field, which is dominated by the polar field in the interior of the critical field, becomes dominated by the neutral field toward the exterior of the critical field. Finally, at a distance 'a' from the surface particles, the polar field disappears completely, and the neutral field expands to cover the entire surface. At this time, the attenuation step size of the field strength of the neutral field increases to the radius of the object, r_0.

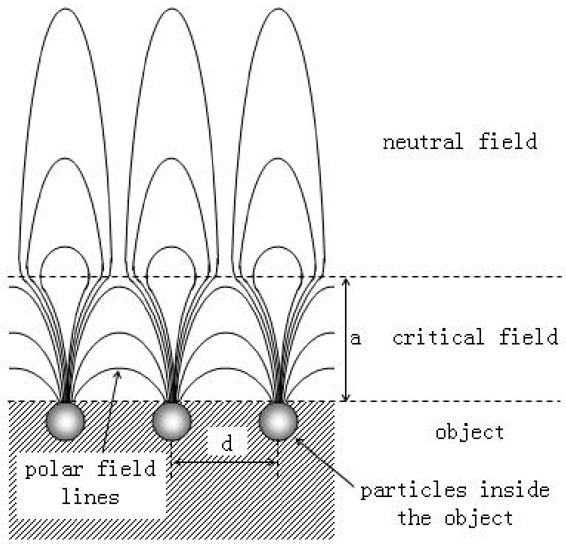

Figure 2 Gravitational-field formation principle

We usually refer to this position at a distance 'a' as the surface of the object, and we refer to the corresponding field strength as the surface field strength of the object. The region beyond 'a' corresponds to the external field of the object, which is a pure neutral field without any polar field component.

Of course, the above discussion provides only an overall description of the process of the formation of a gravitational field; the actual process is much more complicated.

3. Fields of celestial bodies and objects on the Earth's surface

3.1. Fields of celestial bodies

Similar to microscopic particles, cosmoscopic celestial bodies have a three-layered field structure, i.e., an internal field, a critical field, and an external field. As an example, the Earth's field structure is depicted in Figure 3.

The internal field of the Earth consists of the fields of the particles that compose the Earth. The field-strength distribution of the internal field of the Earth is not uniform, and the average field strength on the boundaries of the field domains of the particles is generally defined as the internal field strength of the Earth, B_b. The magnitude of B_b is determined by the particles that constitute the object and their distance. Closer to the center of the Earth, B_b is greater. For macroscopic objects, we generally consider B_b to be constant.

The external field of the Earth is an isotropic neutral field, which is commonly known as Earth's gravitational field. the field strength B of the gravitational field follows the inverse-square law. That is, the magnitude of the field strength B is inversely proportional to the square of the distance r from the center of the object.Then, the field strength B at a distance R ($R \geq R_0$) from the center of the Earth can be expressed as follows:

$$B=B_0 R_0^2/R^2 \quad (1)$$

The attenuation step size of the field strength B of the Earth's gravitational field is the radius of the Earth. Earth's gravitational field is a type of monopole field. It is, in essence, the macroscopic and statistical description of the field formed by many uniformly interlaced N sub-poles and S sub-poles. Monopole fields are not exclusive to neutral fields. Polar fields can also be monopole fields, such as electrostatic fields.

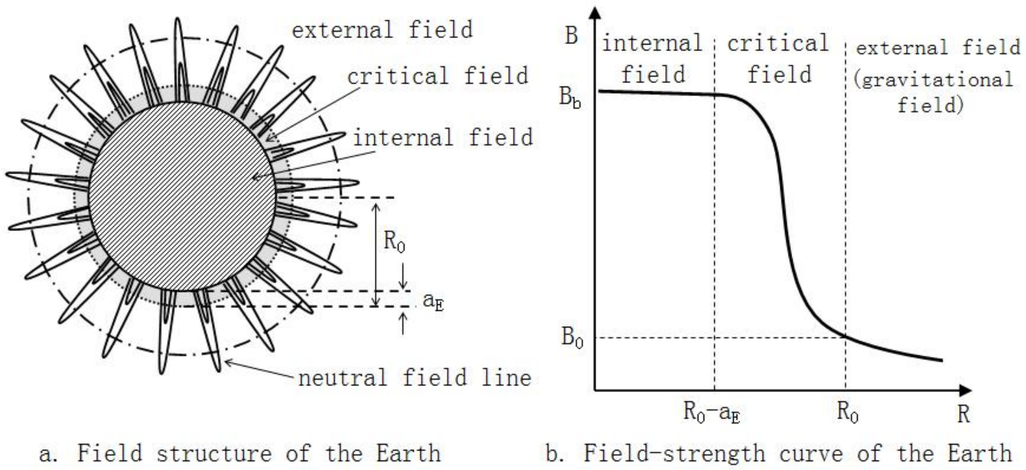

Figure 3 Field structure and field-strength curve of the Earth

In the small domain between the internal field and the external field of the Earth, the field strength changes rapidly; in other words, the attenuation step size of the field strength gradually transitions from the size of the particles inside the Earth to the radius of the Earth. This domain is called the critical field of the Earth.

The critical field and the internal field are connected, and we view the envelope of the boundary of the field domains of the particles as the boundary between the critical field and the internal field; we view the spherical surface corresponding to the radius r_0, where the field strength satisfies equation (1), as the boundary between the critical field and the external field, namely, the surface of the celestial body. The field strength on the surface of a celestial body is denoted by B_0.

The critical field strength is a nonlinear curve, and the magnitude of the field strength is between B_b and B_0. In general, we refer to the critical field domain of an object as the surface layer or surface field of the object, which is a composite field consisting of a neutral field and a polar field.

3.2. Field domain

If we neglect the field strength of the external environment, the field of an object always extends to infinity. However, in the practical environment, there are always fields of other objects surrounding any given object, namely, the **external field** or **environmental field** of the object. The position at which the field strength of an object is equal to that of the external environment is called the field boundary of the object, and the domain inside this boundary is called the **field domain** of the object, as shown in Figure 8.

Let the field strength on the surface of an object and the field strength of its external environment be b_0 and B ($B<b_0$), respectively. According to the equation for the field strength (1), the radius of the **field domain of the object,** r_b, can be expressed as follows:

$$r_b=r_0(b_0/B)^{1/2} \qquad (2)$$

From this equation, it is apparent that the radius of the field domain of the object, r_b, is inversely proportional to the square root of the field strength B of the external environment and proportional to the radius of the object, r_0. Therefore, in the realistic environment, all objects, from cnons to various celestial bodies, have finite field domains, namely, the fields of all objects are **domain specific**.

The field domain of an object is its range of action and is also called the **action domain** of the object. If the field domain of object B is not within the range of the field domain of object A, then there is no interaction between objects A and B. Therefore, so-called action at a distance, interaction that is not affected by distance, does not exist.

3.3. Fields of objects on the Earth's surface

We typically observe objects on the Earth's surface. Because the field strength of Earth's gravity, B_0, is greater than the field strength b_0 on the surface of any typical object, the boundary between the field domains of the object and the Earth's gravitational field is located within the critical field, as shown in Figure 4. That is, the external field of any normal object on the Earth's surface is completely screened by the Earth's gravitational field, meaning that normal objects on the Earth's surface do not possess external fields.

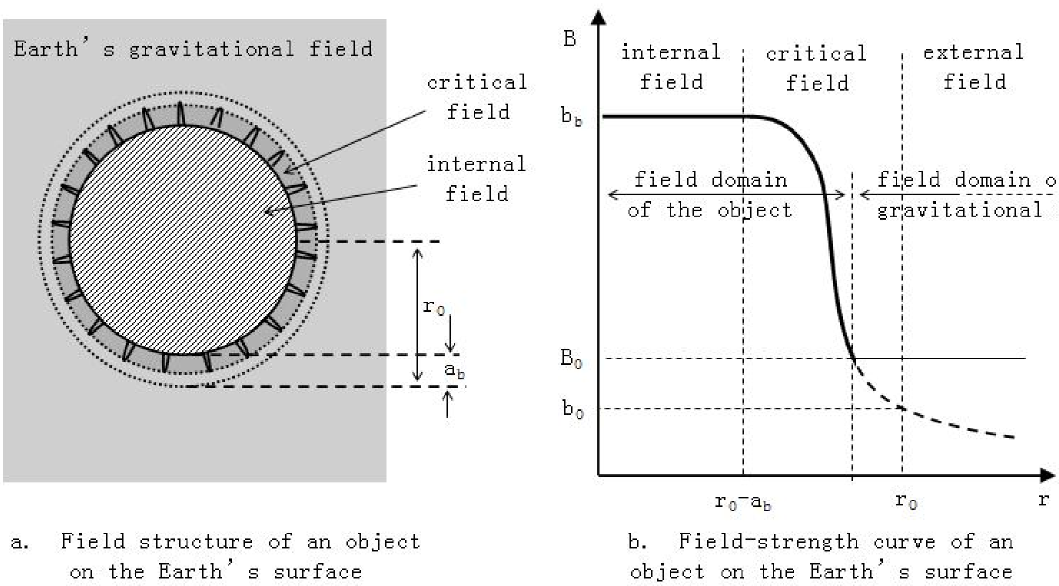

Figure 4 Field structure and field-strength curve of an object

We know that no matter how close two objects approach each other, if there is a gap between the objects, we will not be able to observe any interaction between them. Usually, we believe that this lack of interaction can be attributed to the fact that the masses of the objects are too small. This understanding might not be accurate. In fact, because there is no external field for an object on the Earth's surface, if two such objects are located within the Earth's gravitational field, their field domains do not overlap each other, and therefore, they interact only with the Earth. Similarly, distant celestial bodies have no impact on us because we are located within the Earth's gravitational field and interact only with the Earth.

If we allow these two objects to come into sufficiently close contact with each other, it becomes difficult for us to separate them, and this phenomenon is apparently unrelated to pressure. In fact, in this scenario, the critical fields of these two objects are in sufficient contact that the field lines between the polar fields and neutral fields of the objects are mutually coupled, generating a coupling force. This coupling force is similar to the molecular force in physics, as shown in Figure 5.

The generation of this coupling force is also the reason why the static friction force is greater than the dynamic friction force: before an object begins to slide on a supporting object, the contact surface between the object and the supporting object is relatively large. There are many coupled field lines between the objects, and the force required to drag one across the other is large; after the object begins to slide, however, the contact surface between the object and the supporting object decreases, the number of coupled field lines decreases, and the dynamic friction force correspondingly decreases.

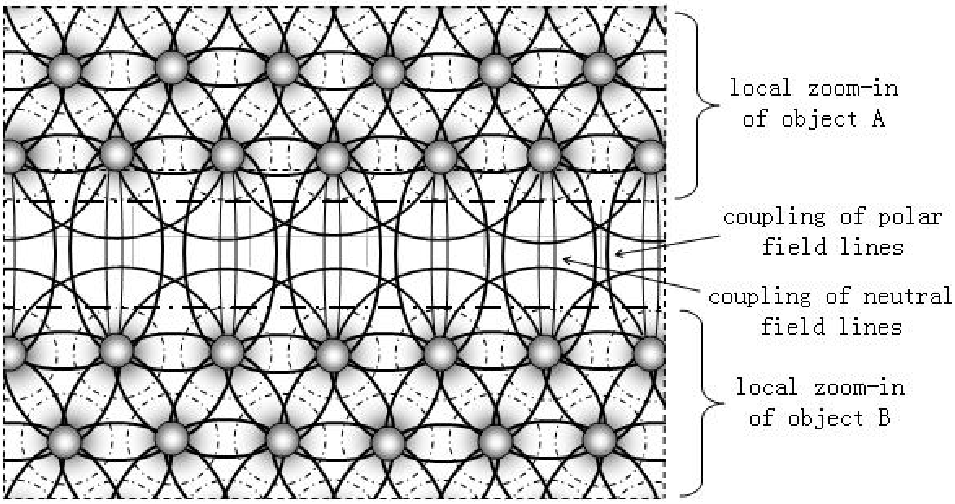

Figure 5 Schematics of interaction between two objects

3.4. Role of the critical field of an object

The critical field of an object is known in physics as the Fermi surface. The critical field does not simply constitute the physical surface of the object; more importantly, it plays an indispensable protective role. As shown in Figure 4b, the critical field of an object is like a rugged dam with a certain thickness and height. This dam blocks the Earth's gravitational field to permit the object to exist independently.

If the external field strength surrounding the object continues to increase, the thickness of the critical field of the object will continue to decrease; when the external field strength becomes greater than the field strength of the internal field b_b of the object, the critical field of the object will disappear. At this time, the particles on the object's surface will lose the protection of the critical field and be directly exposed to the external environment. Under the action of the external field, the particles on the surface of the object will be dispersed layer by layer, and eventually, the object will disappear.

4. Unity of Gravitational field and space

In the Theory of System Relativity, space is the form in which the geometric properties of the shuon field are expressed, and a gravitational field is the form in which the kinetic properties of the neutral shuon field are expressed. Historically, the idea of considering the ether as the noumenon of space unquestionably incorporated space into the domain of matter, which was a significant milestone in modern physics. However, our understanding of the properties of space (the attributes of ether) has undergone several significant changes, and we have not yet formed a clear model of space.

4.1. Distribution of space density

According to the Theory of System Relativity, the space is a continuous medium formed by the shuon fluid, the stress intensity of the shuon fluid, p(i.e., field strength B), is proportional to the space density ρ. According to equation (1), let the space density on the surface of an object be ρ_0 and the radius of the object be r_0. The space density around the object, ρ, can be expressed as follows:

$$\rho=\rho_0 r_0^2/r^2 \qquad (3)$$

We can see that in the field domain of the object, the space density around the object is not uniform, and the magnitude of the space density is inversely proportional to the square of the distance r from the object. Circles of radius r, as illustrated in Figure 6, are called isopycnic lines or contour lines.

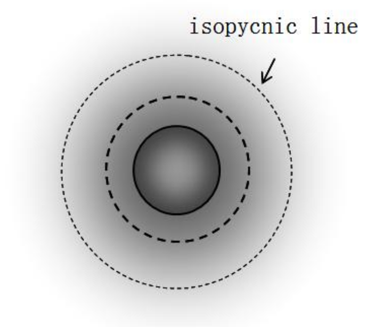

Figure 6 Space-density distribution around a celestial body

A. Einstein's general relativity used a theory based on curved space-time to describe the space-density distribution around an object.

4.1.1. The lensing effect of celestial bodies

Cosmic observations have confirmed that light will be bent while passing through the surfaces of large celestial bodies, causing it to exhibit a lensing effect, as illustrated in Figure 7. A. Einstein believed that the lensing effect was caused by the celestial body increasing the curvature of ambient space-time. The Theory of System Relativity provides a different explanation: the bending of light is caused by the gravitational effect of celestial bodies.

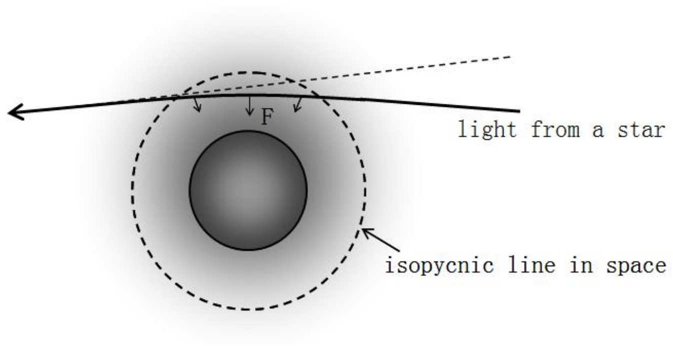

Figure 7 The lensing effect of celestial bodies

Space and fields are descriptions of the shuon fluid from different perspectives. According to the Theory of System Relativity, a photon with covariant motion is subject to the attractive force of the gravitational fields of celestial bodies. Let the vortex flux on the boundary of the photon's field domain be Φ, and let the coefficient of action between the gravitational field and the photon with covariant motion be $k_{\gamma n}$. The force on a photon with covariant motion subject to a gravitational field F can be expressed as follows:

$$F=k_{\gamma n}\Phi \quad (4)$$

When a photon in covariant motion passes the surface of a celestial body, it bends toward the celestial body because of the aforementioned attractive force.

In fact, the convex-lens effect of the critical field is much stronger than the convex-lens effect of the external field of a celestial body. As shown in Figure 8, when a photon passes over the surface of a smooth metal sphere, under the action of the attractive coupling force F in the critical field of the metal sphere, the motion path of the photon is deflected toward the metal sphere. As a result, the light bends to form some light ring and a light spot on a screen placed behind the sphere. This phenomenon is called the **convex-lens effect** of the critical fields of objects, and such light spot are typically called Poisson bright spot.

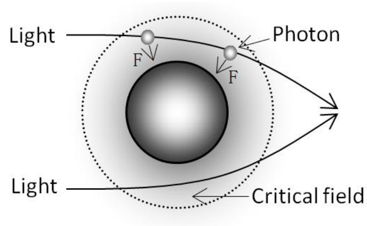

Figure 8 Convex-lens effect of the critical field of an object

In summary, A. Einstein called the bent line traversed by light passing the surface of a celestial body a geodesic line, namely, a straight line in four-dimensional space-time, which is a claim of questionable validity.

4.1.2. Visual effect of the size of the Sun

According to the aforementioned lensing effect of celestial bodies, the size of the Sun as observed from the Earth should be slightly larger than its actual size, as illustrated in Figure 9.

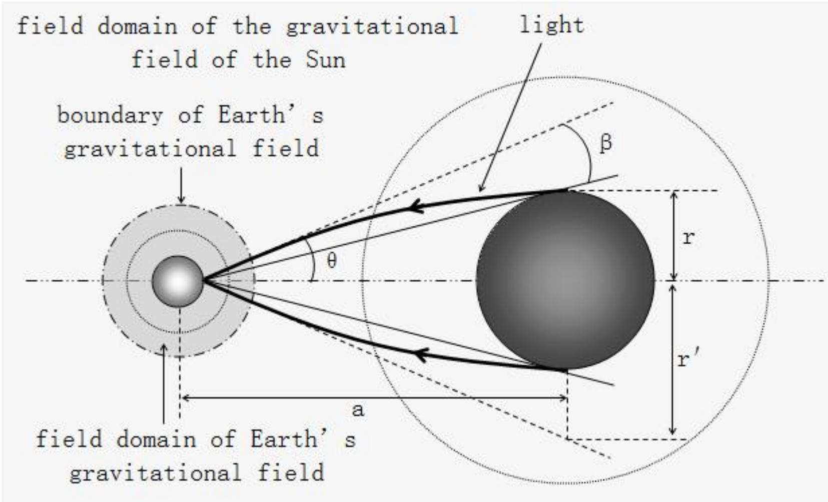

Figure 9 Observational effect of size of a celestial body

When the bending of the light is neglected, the observed radius of the Sun, r', is

$$r' = a \times \sin\theta \tag{5}$$

Because the light bends, however, the actual radius of the Sun, r, should be

$$r = a \times \sin(\theta - \beta) \tag{6}$$

We can see that the observed radius of the Sun is greater than the actual radius. For the same reason, when the Sun is seen on the horizon, it appears larger than when it is seen at noon because the lensing effect on Earth is more apparent in the morning than at noon. As described by S. W. Hawking, we are just like fish in an aquarium: what we see is a Universe that is amplified by the Earth's gravitational field and distorted by the gravitational fields of celestial bodies.

4.2. Structural features of space

According to the field-domain principle, the field domain of an object is the independent space possessed by the object, and this space moves with the object; in other words, this space is stationary relative to the object. Therefore, this space is also called the **absolute space** of the object.

Using the Solar System as an example, the absolute space of the Sun is the entire Solar System. The planets and their absolute spaces are suspended in the absolute space of the Sun, and they move relative to the absolute space of the Sun and are independent of each other, as shown in Figure 10. According to modern cosmoscopic observations, the space outside the Solar System is the absolute space of a black hole at the center of the galaxy.

4.2.1 Examination of the Michelson-Morley experiment and the principle of the constant speed of light

The objective of the Michelson-Morley experiment was to verify the hypothesis that ether exists and is stationary relative to the Sun. The experimental principle is as follows: because Earth moves relative to the ether, an interferometer should reveal the movement of interference fringes. The experimental results indicated that there was no movement of interference fringes, and therefore, the experiment disproved the existence of relative motion between the Earth and the ether.

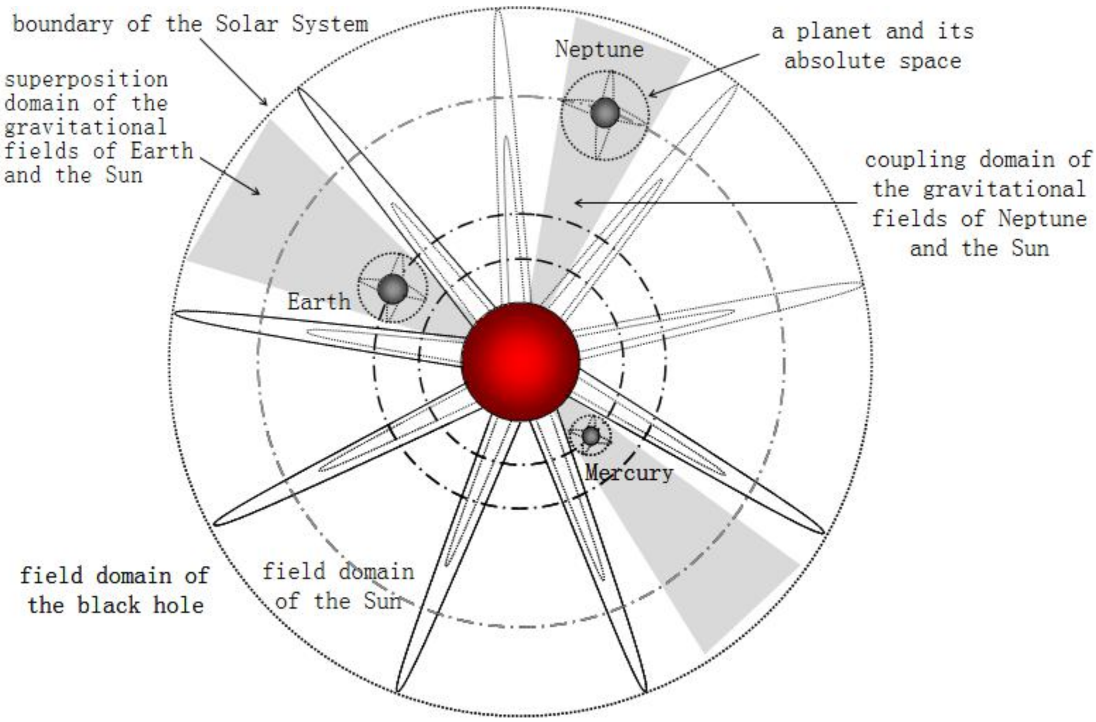

Figure 10 Schematic illustration of the spatial structure of the Solar System

As seen in Figure 10, the Michelson-Morley experiment was carried out within the absolute space of the Earth. Regardless of how the light source moved, when a photon emitted by the light source entered the Earth’s gravitational field, its velocity was related only to the Earth’s gravitational field. In other words, within the Earth’s gravitational field, a photon moves only at the speed of light, c, relative to the Earth (see equation 14). This is called the principle of the constant speed of light.

It is therefore evident that in the Michelson-Morley experiment, the speeds of the two light beams were both the speed of light, c, and the experiment inevitably yielded a "null result."

4.2.2. Examination of the aberration of light

The so-called aberration phenomenon is the phenomenon in which the position (visual position) of a star seen from the ground is slightly offset from the actual position of the star. General relativity attributes the aberration phenomenon to the problem that "the motion of light is affected by attractive forces." According to the discussion presented above, the aberration phenomenon is primarily the consequence of the relative motion(including revolution and rotation) of the absolute space of the Earth (namely, the field domain of the Earth) within the field domain of the Sun.

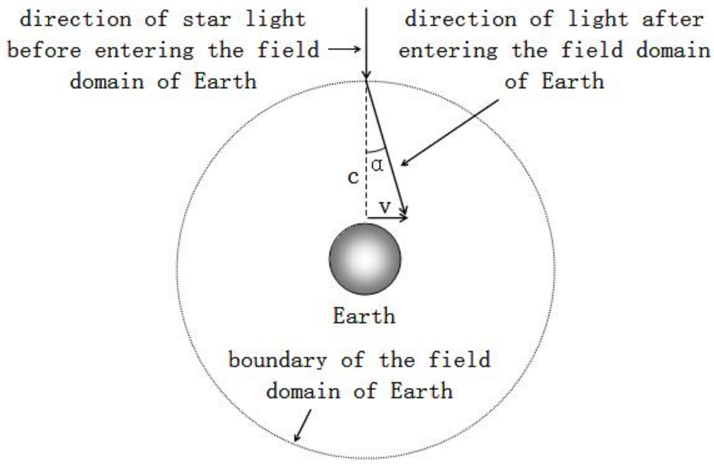

Figure 11 Schematics of the light aberration phenomenon

In 1725, British astronomer Bradley found that to observe stars immediately above the zenith, he was required to deviate the telescope from the vertical line by approximately 20.5", as shown in Figure 11. In fact, between an observed star and the Earth, the light from the star passes sequentially through the rotating stellar space, the absolute space of the black hole at the center of the galaxy, the rotating solar space, and the moving geospace. This phenomenon clearly cannot be completely described by the revolutionary speed of the Earth.

Therefore, the interpretation of general relativity is questionable.

4.2.3. Investigation of gravitational effects between planets

For Earth and Mars, the projection region back to the Sun outside the Earth's field domain is a superposed gravitational field that is formed jointly by the Sun and the Earth, as shown in Figure 10. When Mars enters this projection region, the gravitational force between Mars and the Sun changes in response to the gravitational force of the coupling bodys formed by the Sun and the Earth.

On the one hand, because the projection gravitational field is the superposed field of the Sun and the Earth and the field strength slightly increases, Mars is subject to a larger gravitational force and therefore undergoes an internal shift; on the other hand, Mars also simultaneously generates a gravitational force on the Sun and the Earth. As a result, the Earth shifts in the direction of Mars under the gravitational force of Mars.

When Mars moves out of the superposed gravitational field domain of the Earth and the Sun, there is no longer any interaction between Mars and the Earth, and Mars interacts only with the Sun.

4.2.4. Establishing the frame of reference

According to the discussion presented above, on the one hand, the space of the Universe, which initially seems to be a whole, is actually divided by the celestial bodies it contains, and there is relative motion in the Universe; on the other hand, there is actually a space-density distribution in this universal space that seems to be uniform. This spatial structure not only causes light to deflect and bend but also indicates that reference frames cannot be arbitrarily selected. All these consequences profoundly affect our observations of the Universe.

In summary, the motion of objects is actually the movement of relative spaces (gravitational fields), and the presence of absolute spaces means that reference frames cannot be selected arbitrarily.

5. Division of the Earth's field domain

In this section, we use a man-made satellite of Earth as an illustrative example. According to the discussion provided above, a man-made satellite of Earth is located within the Earth's gravitational field, and a study of the motion of such a man-made satellite of Earth should use the Earth as its frame of reference. We know that this man-made satellite of Earth has a stationary orbit (as shown in Figure 13). If we use the Earth as our frame of reference, how can we explain the phenomenon of an object in the Earth's gravitational field becoming stationary in the air?

5.1. The analysis of the force on the object in the field domain of the Earth

According to the Theory of System Relativity, the field functions of different objects are different. To constitute a stable system, these fields must undergo covariant motion to achieve a saturated degree of vortex-tube coupling such that their mutual attractive force reaches a maximum and therefore enter the steady state. The implicit prerequisite of this prescription is that every object in the system has an external field.

However, for any objects on the Earth's surface, its surface field strength b_0 is smaller than the field strength of the gravitational force on the surface, B_0. Therefore, surface objects do not have external fields, and the boundaries of the field domains of such objects are located inside their critical fields. In other words, the Earth's gravitational field penetrates into the critical fields of objects, and there is a interaction between the Earth's gravitational field and the particles on the surface of the object, as shown in Figure 12.

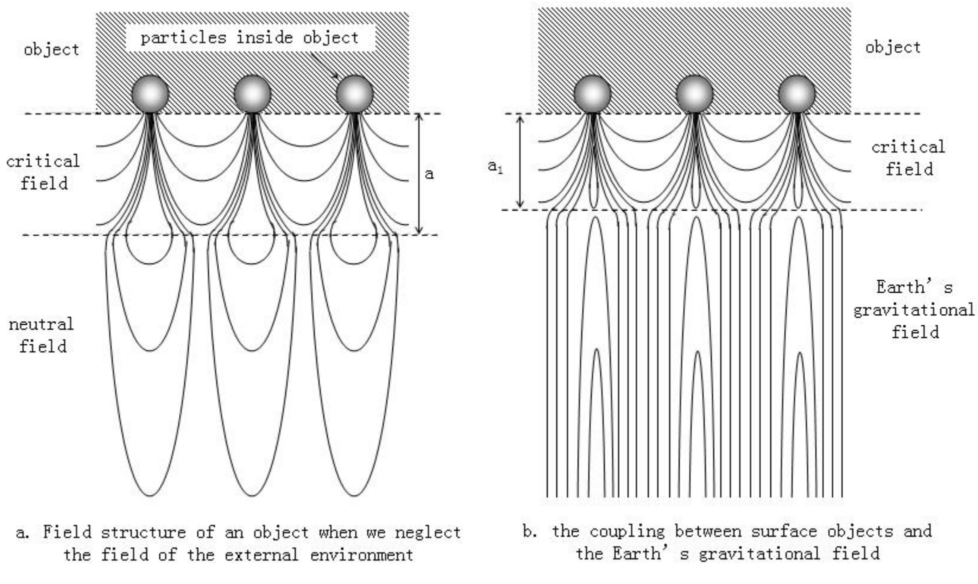

Figure 12 Schematic illustrations of the coupling principle between the objects and the Earth's gravitational field

Therefore, under the influence of the Earth's gravitational field, the field function of particles on the surface of the object changes covariantly, and then the field function of particles inside the object changes covariantly. Finally, the field function of the whole object changes covariantly, therefore the degree of vortex-tube coupling between the neutral field of the object and the Earth's gravitational field is in the saturated state. In other words, a object on the surface is always subject to the saturated gravitational force of the Earth, F.

The farther the object is from the surface of the Earth, the weaker the strength of the Earth's gravitational field. When the Earth's gravitational field penetrates less deeply into the critical field of the object, the coupled vortex flux with the neutral field of the object is less, and the Earth's gravitational force F on the object is less. When the object is in a stationary orbit R_S, the boundary of the field domain of the object reaches the outer boundary of the critical field. The surface field strength b_0 of the object is equal to the field strength B of the gravity of the Earth at this position; in other words, $b_0=B$.

In a stationary orbit, because of the motion of the surface matter of the Earth and its interior motion, there are small fluctuations in the gravitational field function of the Earth, and therefore, the external field of the object sometimes appears or disappears. In this scenario, the neutral field of the object and the Earth's gravitational field are in an entangled state of matching and unmatching. When $B<b_0$, the object has an external field, and the field functions do not match (the object field returns to the intrinsic field function), causing the object to be subject to a repulsive force; when $B>b_0$, the object has no external field, and the field functions match, causing the object to be subject to an attractive force. From the perspective of the time interval, the action on the object is zero, namely, $\int Fdt=0$.

When the object moves away from the Earth (i.e., $R>R_S$), the field strength on the surface of the object, b_0, is greater than the field strength B of the Earth's gravity at that position; in other words, $b_0>B$. In this scenario, the object has an external field. The field function of the object is no longer affected by the Earth's gravitational field, and it exhibits its inherent intrinsic property. If, at this time, the object remains stationary, it will be subject to a repulsive force in the Earth's gravitational field because its field function does not match the gravitational field function of the Earth. In modern physics, such repulsive nature of the gravitational field is described by the concept of dark energy.

5.2 Stationary attractive region and stationary repulsive region

In conclusion, based on the force acting on a satellite that is stationary relative to the Earth, we can divide the Earth's field domain into a stationary attractive region and a stationary repulsive region for satellites. The boundary of these two regions is the stationary satellite orbit, as shown in Figure 13. An object inside the stationary attractive region is always subject to an attractive force; therefore, this region is also called the **attractive region** of the object. An object inside the stationary repulsive region is always subject to covariant motion; therefore, this region is also called the **motion region** of the object.

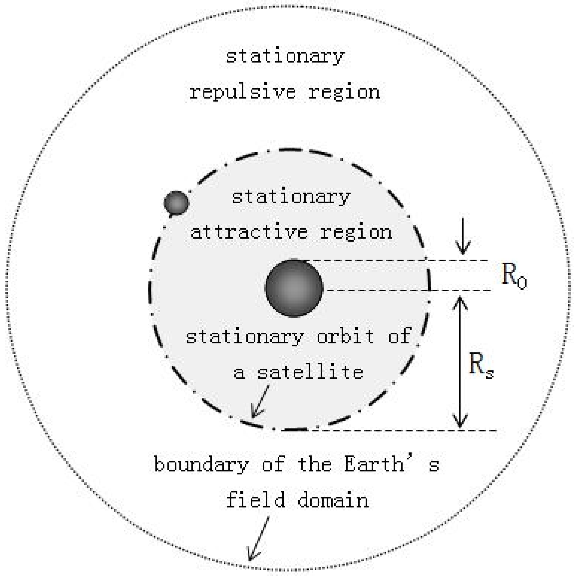

Figure 13 Functional division of the Earth's field domain

In the motion region, the most commonly observed motion of objects in nature is usually covariant motion, which is a self-consistent motion compatible with the environmental field. This type of motion has relatively good stability and is also known as steady-state motion; examples are the motion of the planets in the Solar System and the motion of electrons in atoms. The motion of objects in the attractive region is usually forced motion. Objects monotonically approach the surface and eventually fall to the ground. Therefore, the motion of objects in the attractive region is unstable. A typical example of an object with such unstable motion is a near-Earth satellite.

A comparison of the characteristics of the attractive region, a stationary orbit, and the motion region is presented in the table 1:

table 1

Division of regions	Radius	Stationary force	Apparent energy of objects	Steady-state velocity
Region of attractive force	$R<R_S$	F>0, attractive force	Φ_0-Φ<0, indicative of negative energy	v>0; the larger the radius of the motion orbit is, the lower the velocity
Stationary orbit	$R=R_S$	$\int Fdt=0$	Φ_0-Φ=0, not indicative of energy	v=0, stationary
Motion region	$R>R_S$	F<0, repulsive force	Φ_0-Φ>0, indicative of positive energy	v>0; the larger the radius of the orbit of motion is, the higher the velocity

Let the radius of the Earth be R_0. According to the formula for the field strength, the radius of a stationary orbit, R_S, can be expressed as follows:

$$R_S=(B_0/b_0)^{1/2}R_0 \quad (7)$$

Therefore, the so-called gravitational field does not exert only attractive forces on objects, and therefore, the concept of gravitational fields is inaccurate. We should replace the concept of gravitational fields with the concept of neutral fields to facilitate a correct understanding of the Universe. Otherwise, we are obliged to introduce the concept of dark energy. Apparently, the concept of gravitational fields has led us astray.

6. Covariant motion equation

6.1. Relative energy of the object

Usually, we consider the surface vortex flux of an object, Φ_0, to be its energy. However, in a realistic environment, an object has a field-domain boundary. The vortex flux Φ on the boundary of the field domain is absorbed by the external environment; it participates in interaction with the external environment. This portion of the object's energy is called the **interaction energy**. Therefore, the actual apparent energy exhibited by the object is Φ_0-Φ, which is called the **relative energy** of the object.

From the vortex-flux formula and the field-strength formula, it is straightforward to derive the expression for the relative energy (Φ_0-Φ):

$$\Phi_0-\Phi=\Phi_0(1-B/b_0)=\Phi_0[1-B_0R_0^2/(b_0R^2)] \qquad (8)$$

The relative energy of an object is related to its velocity of the covariant motion, and the interaction energy of the object is related to the force.

6.2. covariant motion equation in the gravitational field

As mentioned above, in the motion region, the velocity of the motion of an object, v, is always related to the relative energy (Φ_0-Φ) of the object. On this basis, the Theory of System Relativity states that

$$v^2=\underline{v}^2(\Phi_0-\Phi)/\Phi \qquad (R\geq R_S) \qquad (9)$$

By introducing the vorticity formula[1] into the equation above, we obtain

$$v^2=\underline{v}^2(b_0/B-1) \qquad (R\geq R_S) \qquad (10)$$

By introducing $B=B_0R_0^2/R^2$ and $\underline{v}^2b_0=\underline{k}_v$ [1] into the equation above, we obtain

$$v^2=k_v^2R^2-\underline{v}^2 \qquad (R\geq R_S) \qquad (11)$$

where $k_v=\underline{k}_v/(B_0R_0^2)$ is a systematic coefficient that is not related to the object.

Equations (10) and (11) are called the **covariant motion equations** of the object. Based on the relevant parameters, such as the gravitational acceleration, of a man-made satellite and the moon as well as the stationary parameters (calculation not shown here), curves illustrating the relationship between the orbital velocity v and the orbital radius R during the covariant motion are depicted in Figure 14.

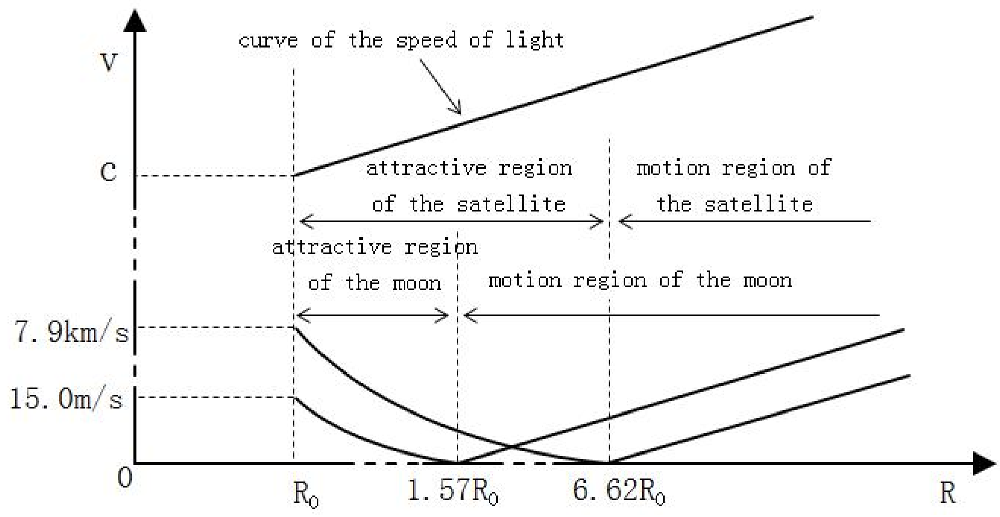

Figure 14 Steady-state velocity curves in the Earth's field domain for the moon and a man-made satellite

In the Earth's field domain, the moon is located in the motion region (namely, the static repulsive region). Therefore, the moon tends to move away from the Earth, which is consistent with actual observations of a 3.8-cm drift every year.

When $B<<b_0$, by referring to equation (10), equation (11) can be simplified to

$$v=k_vR \tag{12}$$

According to the equation above, in the Earth's field domain, when $B<<b_0$, the steady-state velocity(covariant velocity) of a satellite is proportional to the radius of its orbit. Apparently, k_v is the angular velocity of the satellite. In other words, under the aforementioned conditions, satellites in different orbits have the same constant angular velocity k_v. This result is not consistent with our observations of the Solar System. We will further discuss this inconsistency in the following sections.

6.3. Examination of the revolution of the planets in the Solar System

In the Solar System, the field domains of eight planets are located within the field domain of the Sun. Most of the time, there is only direct interaction and relative motion between each planet and the Sun. Therefore, a study of the planetary motion should use the Sun as its frame of reference.

We are accustomed to using extra-solar stars as the frame of reference (without considering the self-rotation of the Sun) to observe and analyze the motion of the planets. If we use the Sun as our frame of reference, the orbital parameters of the planets will be entirely different. The data regarding the motion of individual planets in these two reference frames are provided in the table 2.

According to this table, when extra-solar stars are used as the frame of reference, the motion velocity of a planet that is farther from the Sun will be smaller; when the Sun is used as the frame of reference, the motion velocity of a planet that is farther from the Sun will be greater. Using the orbital radius of the planet, R, as the horizontal axis and the revolutionary velocity v' of the planet in the reference frame of the Sun as the vertical axis, we establish the coordinate system depicted in Figure 15. It is clear that the motion of the planets in the reference frame of the Sun satisfies the covariant motion equation (11). Therefore, all eight planets in the Solar System are located in their motion regions.

Cosmic observations have confirmed that the cosmic microwave background radiation is anisotropic. It is generally believed that this anisotropy originates from the motion of the Earth relative to the microwave background, which is approximately 390±60 km/s. By comparison with the revolutionary velocity of the Earth with the Sun as the frame of reference, which is 345 km/s, we find that these two datasets are generally consistent.

table 2

		Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Orbit radius R m		5.791×10^{10}	1.082×10^{11}	1.496×10^{11}	2.279×10^{11}	7.783×10^{11}	1.429×10^{12}	2.875×10^{12}	4.504×10^{12}
In the reference frame of the ambient environment	Revolutionary cycle T_2 year	0.2408	0.6152	1	1.8807	11.857	29.423	83.747	163.72
	Revolutionary velocity v m/s	4.791×10^4	3.504×10^4	2.981×10^4	2.414×10^4	1.308×10^4	9.676×10^3	6.84×10^3	5.481×10^3
In the reference frame of the Sun	Revolutionary cycle T' day	35.684	28.614	27.277	26.354	25.53	25.44	25.401	25.391
	Revolutionary velocity v' m/s	1.02×10^5	2.376×10^5	3.45×10^5	5.433×10^5	1.915×10^6	3.529×10^6	7.112×10^6	1.115×10^7

Of course, the velocity given in the table above is calculated according to a stellar cycle of

25.38 days for the self-revolution of the Sun. This cycle is equivalent to the self-revolutionary period of the Sun at a 26° latitude. According to astronomical data, the self-revolutionary period of the Sun at the equator is 24.47 days, and using this value, the speed of the revolution of the Earth is calculated to be 413 km/s. In addition, in this calculation, we did not account for the ecliptic inclination of 7.25° of the solar equator, and we used the semi-major radius of the revolutionary orbit of the Earth.

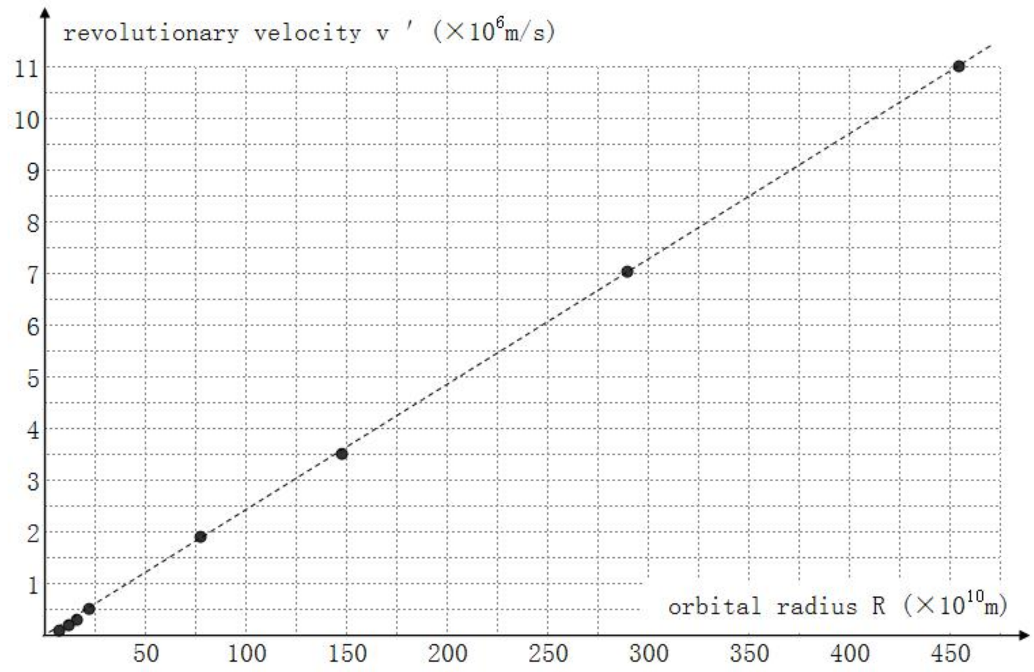

Figure 15 Regularity of planetary motion in the reference frame of the Sun

Therefore, the essence of the so-called "movement of the Earth relative to the microwave background" is the motion of the Earth relative to the field domain of the Sun; in other words, the aforementioned "microwave background" in fact refers to the field domain of the Sun. This observational fact can be interpreted as powerful evidence for the covariant motion equation of the Theory of System Relativity and also calls into question the widely accepted statement that "the revolutionary velocity of the Earth is 29.8 km/s."

7. Equation of the speed of light

We know that light slows down when it enters the medium. It is not difficult to find that there is the Earth's gravitational field outside the medium, and there is the fields of the particles inside the medium. Apparently, the field inside the medium is much stronger than the field of the earth's surface, as shown in Figure 4b. In other words, the changes of the speed of light are caused by the differences in field strength (namely, space energy density).

Moreover, the convex lens effect of celestial bodies and the refraction phenomenon of light indicated that the deflection of light is closely related to the change of field strength, as shown in Figure 7 and Figure 16. Since according to the refractive index in the refractive phenomenon, we can calculate the smaller velocity value of light in the medium, then, according to the curvature of light in the celestial convex lens effect, we can also calculate the reductions of the speed of light when the light passes near the celestial body.

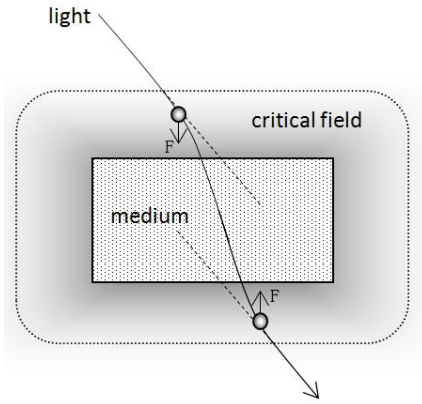

Figure 16 Refraction phenomenon

It can be seen that the speed of light in the vacuum is not a constant. Now we will discuss the equation of the speed of light in the Theory of System Relativity.

The photon's motion state in the surface environment is a consequence of covariation based on the function of the Earth's gravitational field. After replacing b_0 and B with the surface space density of the photon, ρ_0, and with the space density of the gravitational field (namely, the space density on the boundary of the photon's field domain), ρ, respectively, equation (10) can derive the general motion equation for a photon in a gravitational field:

$$v=\underline{v}\,(\rho_0/\rho-1)^{1/2}=[\underline{k}_v/\rho(1-\rho/\rho_0)]^{1/2} \qquad (13)$$

From this equation, it appears that photons with the same energy in different fields(namely, different field strength) or photons with different energies in the same fields have different velocities. Two typical examples are in the follow.

For example, in the convex lens effect of celestial bodies, the convex lens effect will be weaker when the light is farther from the celestial body, which indicates that the speed of light is the higher when the field strength is smaller.

For another example, in Newton's Triple Prism Dispersion Experiment, the refractive index of light is greater when the energy of the photon is higher, which indicates that the speed of light is lower when the energy of photon is higher.

In the space of the Earth's surface, there are certain differences in the surface space density ρ_0 for photons with relatively large differences in energy levels, namely, a photon with low energy has a relatively large surface space density. According to equation (13), a photon with low energy has a relatively high velocity. However, because the surface space density of the photon, ρ_0, is much larger than the space density ρ on the surface, the following holds: $1-\rho/\rho_0 \approx 1$, we find that

$$v \approx (\underline{k}_v/\rho)^{1/2} = c \qquad (14)$$

namely, the speed of light on the surface is approximately $(\underline{k}_v/\rho)^{1/2}$.

We can see that the so-called speed of light, c, is a constant when the surface space density of the photon is neglected and is related to the surface space density of the Earth. The speed of light c is usually measured for visible light on the Earth's surface; therefore, it is more appropriately called **the speed of visible light on the Earth's surface**.

In addition, there is some question regarding the superluminal nature of neutrinos. In September of 2011, it was reported on the website of Nature magazine (UK) that European researchers had observed neutrinos traveling at superluminal velocities. This claim of discovery was retracted in May of 2012 because of "a problem with fiber-optic connections." In the Theory of System Relativity, the radius of the neutrino is believed to be smaller than that of a visible photon, and its surface space density is believed to be larger than that of a visible photon. According to equation (13), the velocity of the covariant motion of the neutrino on the surface of the Earth should indeed be greater than the speed of light, c. This is the explanation for the Italian scientists' recent discovery that the neutrino is superluminal.

The validity of the so-called "problem of fiber-optic connections" is questionable.

8. Closings

What is lacking in determining the correctness of the gravitational field model in this paper is more testing. More people are welcome to participate and criticize.

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