Original Paper

On the Unification of the Precession of the Foucault Pendulum, the Earth's "Precession" and the Mercury Precession by Constructing the Vortex Gravitational Mechanism

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Abstract

Gravitation is generated between static objects, while vortex gravity is generated between moving objects. Forming the integrity and completeness of gravity theory, these complement each other. The vortex gravity mechanism of moving objects is established to solve the objective problem of vortex gravity. The precession of Foucault's pendulum, the precession of the Earth and the precession of Mercury are objective phenomena, for which there are many different explanations. The author suggests, only by the mechanism of vortex gravity can reveal their operation law and unity of operation. Through the analysis and calculation in this paper, the precession value of mercury produced by vortex gravity is 5025.6", which is different from the observed value 5600", the deviation is -10.26%. which also proves the rationality and effectiveness of establishing the mechanism of vortex gravity. Therefore, the explanation that Mercury precession is caused by planets such as earth is fetched and unreasonable. The establishment of vortex gravitation mechanism can generally solve the kinematic problems of vortex gravitation caused by the motion of objects in physics, geophysics and astronomy. Furthermore, the problem about the determination of the vortex gravitational field strength B_g and the vortex gravitational constant k_g in the solar system is put forward. Vortex gravity is the attraction between moving objects, The construction of vortex gravity theory is construction of the basic theory.

Keywords

unification, vortex gravitational mechanism, Foucault pendulum, Earth's "precession", mercury precession, two complement each other, vortex gravitational field strength B_g, vortex gravity constant k_g, basic theory

1. Introduction

(1) The Research of the Vortex Gravity is about the Gravity of Moving Objects

The object has static and dynamic states, the action between static objects is universal gravitation. Considering the symmetry of physical state and action, there should be corresponding gravitational action and energy field between moving objects. Independent of universal gravitation, vortex gravitation is the gravitation between moving objects, which is a dynamic force. The theoretical construction (Yuan, 2012, 2014, 2016a) of vortex gravitation and energy field together with universal gravitation constitute the symmetry, completeness and integrity of gravitational theory.

(2) The Precession of Celestial Mechanics Cannot be Understood without Vortex Gravity Theory

Because there is no theory of gravitation of moving objects, the phenomenon of gravitation of moving objects cannot be correctly understood. For example, the precession of Foucault pendulum is generally explained (Cheng, Hu, & You, 1990) by Coriolis force; As for the "precession" of the earth, it is believed that it is the inhomogeneity and asymmetry of the earth's structure and the interaction with other celestial bodies (Su, 2000);The "Mercury precession" is also explained by the interaction force between celestial bodies in the solar system (Wang, 2013).The author believes that Coriolis force is a mechanical model (Yuan, 2014) artificially set according to physical phenomena, therefore, Coriolis force is not the driving force of Foucault pendulum precession. In essence, the precession of the Foucault pendulum is a vortex gravitational movement phenomenon caused by the motion of the Foucault pendulum in the earth's vortex gravitational field. Foucault pendulum precession, earth precession and mercury precession seem to be independent, and people have made independent explanations for these three motion phenomena, in fact, these three kinds of operations are only different motion forms under the action of vortex gravity, and they are internally unified in the operation mechanism of vortex gravity. Because of the lack of the basic theory of gravitation of moving objects, all the problems of gravitation dynamics caused by moving objects, such as the movement of celestial bodies, are now explained by some fitting and taken for granted ideas. The academic community is often used to and stuck to some seemingly mature theories to make meaningless theoretical extensions to those unknown worlds, while ignoring relevant academic objections. For example, the so-called mainstream explanation of Mercury's precession has been ignored due to relevant disputes (Yuan, 2012; Hua, 2009; Mei & Yu, 2016).

(3) The Motion of Planets in the Celestial Vortex Gravitational Field will Produce Precession

It has been demonstrated (Yuan, 2012, 2014, 2016a) that the precession of the planets in the solar system can be directly expressed as: When the planets move around the sun under the action of universal gravitation, they precess along the direction of travel under the action of the vortex gravitational field of the solar system. Planetary motion is a comprehensive motion under the action of universal gravitation and vortex gravitation. The earth's precession caused by the vortex gravity of the solar system makes the earth's vernal equinox move westward every year 50.2786″. The orbital

difference formed in one year is called the earth precession; The orbit difference formed by mercury in the earth's 100A is called mercury precession.

Vortex gravity is an objective force between moving objects. The field of vortex gravity is the gravity energy field produced by moving objects. The understanding (Yuan, 2012, 2014, 2016a) of vortex gravitation will enable us to form a new understanding of the interaction of moving objects, the energy field of moving objects, and the structure of galaxies. At the same time, the atmospheric cyclone under the action of vortex gravity is discussed.

(4) Establishment of Operation Mechanism

In this section, based on the modeling of the mechanism (Yuan, 2012, 2014, 2016a) of vortex gravitation, the theoretical construction of vortex gravitation is described.

1.1. force of moving object in vortex field: $\mathbf{F} = \mathbf{m}\mathbf{v}\mathbf{B_g}$ (1)

above formula: moving object m, speed of moving object $\mathbf{v}$, vortex gravitational field $\mathbf{B}_g$. the angular scale g represents the vortex gravitational field generated by gravity .

1.2. vortex attraction of rotating objects: $m\dfrac{v_1^2}{r} = mv_0 B_g$ (2)

above formula: Precession circumferential speed v_1, Object moving speed v_0.

1.3. $\mathbf{F} = m\mathbf{a} = m\mathbf{v}\mathbf{B}_g$ (3)

1.4.   From formula (3), $\mathbf{a} = \mathbf{v}\mathbf{B}_g$ (4)

1.5. $s = \dfrac{1}{2}at^2$ (5)

1.6. Replace (4) with (5), $s = \dfrac{1}{2}vB_g t^2$ (6)

2. The Precession of Foucault Pendulum under the Action of Vortex Gravity

2.1. When Demonstrating the Precession of Foucault Pendulum, We must Make Clear the Following Points

2.1.1. Since the time of one rotation of the earth is 24h, it will return to the original starting point after 24h at any position on the earth.

2.1.2. If the rotation time of the Foucault pendulum is equal to 24h, it means that the pendulum of the Foucault pendulum swings in the original position without precession.

2.1.3. If the time for the Foucault pendulum to complete the rotation of 360 degrees is less than 24 hours, it indicates that when the Foucault pendulum swings, there is precession opposite to the earth's rotation direction, that is, clockwise precession, thus shortening the time for the Foucault pendulum to complete the rotation of 360 degrees.

2.1.4. If the time for the Foucault pendulum to complete the rotation of 360 degrees is more than 24 hours, it indicates that when the Foucault pendulum swings, there is precession in the same direction as the earth's rotation, that is, counterclockwise precession, thus extending the time for the Foucault

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pendulum to complete the rotation of 360 degrees.

2.1.5. The Direction of Foucault pendulum precession in Beijing and Paris

The rotation time of the pendulum placed in Beijing and Paris in the northern hemisphere is greater than 24 hours, indicating that the swing of the pendulum in Beijing and Paris is in the same direction as the rotation of the earth, which is in line with the counterclockwise precession described in Section 2.1.4 above.

2.1.6. Relevant eigenvalues of Foucault pendulum motion

Foucault pendulum: the pendulum is 67m long, the weight of the hammer is 28KG, and the moving diameter of the pendulum is 6m.

Arc length of one cycle of operation of Foucault pendulum:

$$s = 2\pi r = 2\pi \times 3 = 18.8496(m)$$

Period of Foucault pendulum: $T = 2\pi\sqrt{l/g} = 2\pi\sqrt{67/9.81} = 16.42(s)$

the average speed of the pendulum hammer:

$$v = \frac{L}{T} = \frac{12}{16.42} = 0.730816(m/s)$$

2.2. Analysis of the Precession of Foucault Pendulum in Beijing

Latitude of Beijing: $\varphi = 39^0 54' = 39.9^0$,

The time for the Foucault pendulum to run 360 degrees: 37 hours and 15 minutes, that is, 37.25h.

From formula (2): $m\dfrac{v_1^2}{r} = mv_0 B_g$

The speed v_1 in the left formula is the precession speed of the Foucault pendulum, the speed v_0 in the right formula is the movement speed of the Foucault pendulum, and the radius r of the Foucault pendulum in the left formula.

The Earth rotates for 37.25 hours, corresponding to the resulting Foucault pendulum Angle：

Earth rotation angle at 37.25 hours： $\varphi = \dfrac{360^0 \times 2}{48} \times 37.25 = 558.75^0$

The actual precession speed v_1 and precession distance s_1 of the Foucault pendulum when it rotates counterclockwise for 37.25 hours:

$$v_1 = \frac{s}{T} \cdot \frac{\Delta\varphi}{360^0} = \frac{2\pi \times 3}{37.25 \times 3600} \times \frac{558.75^0 - 360}{360^0} = 7.7603 \times 10^{-5}(m/s)$$

$\Delta\varphi$ is the precession angle generated by Foucault pendulum in 37.25hour.

$s_1 = v_1 \cdot t = 7.7603 \times 10^{-5} \times 37.25 \times 3600 = 10.4066(m)$

According to section 1.1, the strong direction of the vortex gravitational field is parallel to the north-south polar axis of the earth. The vortex gravity of the Foucault pendulum is the product of the vertical component of the vortex gravitational field and the pendulum movement direction. Therefore, it should be multiplied by the sinusoidal value of the angle between the Foucault pendulum line and the equatorial plane of the earth, formula (6) is:

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$$s = \frac{1}{2}vB_g t^2 \sin\varphi \qquad (7)$$

According to formula (7), Vortex gravitational field strength in Beijing position:

$$B_g = \frac{2s_1}{vt^2 \sin\varphi} = \frac{2\times10.4066}{0.7308\times(37.25\times3600)^2 \sin 39.9^0} = 2.469\times10^{-9}\left(t^{-1}\right)$$

In formula, v is the Foucault pendulum speed $v = 0.7308 m/s$.

2.3. Analysis of the Precession of Foucault Pendulum in Paris

Latitude in Paris: $\varphi = 48^0 50' = 48.833^0$

The time of the Foucault pendulum at Paris running 360^0: 31 Hours and 47 minutes, that is, the 31.783h.

The angle of Earth rotation corresponding to 31.783 hours:

$$\varphi = \frac{360^0 \times 2}{48} \times 31.783 = 476.745^0$$

The actual precession speed v_1 and precession distance s_1 of the Foucault pendulum when it rotates counterclockwise for 37.25 hours:

$$v_1 = \frac{s}{T} \cdot \frac{\Delta\varphi}{360^0} = \frac{2\pi\times3}{31.783\times3600} \times \frac{476.745^0 - 360^0}{360^0} = 5.3425\times10^{-5}\,(m/s)$$

$$s_1 = v_1 t = 5.3425\times10^{-5} \times 31.783\times3600 = 6.1128\,(m)$$

Vortex gravitational field strength in Paris position:

$$B_g = \frac{2s_1}{v_0 t^2 \sin\varphi} = \frac{2\times6.1128}{0.7308\times(31.783\times3600)^2 \sin 48.833^0} = 1.6975\times10^{-9}\left(t^{-1}\right)$$

3. Earth's Vortex Gravitational Field Strength

3.1. The Vortex Gravitational Field Strength at the Earth's Location in the Solar System

Earth-related physical parameters: the average distance between the earth and the sun 1.49598×10^{11} m , the Earth radius 6.3781×10^{6} m , the return year 365.2422d, Earth sidereal year: 365.2564d, the earth precession $50.26''/a$.

The Earth's travel speed around the Sun:

$$v_0 = \frac{s}{T} = \frac{2\pi\times1.49598\times10^{11}}{365.2422\times24\times3600} = 2.9786\times10^4\,(m)$$

Arc distance corresponding to the Earth's "precession":

$$s_1 = \frac{50.26''\times2\pi\times1.496\times10^{11}}{360^0\times3600} = 3.6434\times10^7\,(m)$$

The vortex gravitational field strength at the earth's location in the solar system, by formula (6):

$$B_g = \frac{2s_1}{v_0 t^2} = \frac{2\times3.6434\times10^7}{2.9786\times10^4 \times(365.2422\times24\times3600)^2} = 2.4566\times10^{-12}\left(t^{-1}\right)$$

3.2. Circular Motion of Earth's Precession

Precession speed of the earth:

$$v_1 = \frac{s_1}{T} = \frac{3.6264 \times 10^7}{365.2422 \times 24 \times 3600} = 1.1492(m/s)$$

From formula(2), Circumferential radius of earth precession:

$$r_1 = \frac{v_1^2}{v_0 B_g} = \frac{1.1492^2}{2.9786 \times 10^4 \times 2.4451 \times 10^{-12}} = 1.8134 \times 10^7 (m) = 1.8134 \times 10^4 (km)$$

4. Mercury Precession

The vortex gravity of the solar system generates the precession of the planets in the solar system, that is, the earth precession and the mercury precession. Mercury and the earth are planets in the solar system, and their precession is comparable. Therefore, the vortex gravitational field strength of the solar system can be determined by the earth precession, and then the precession of mercury can be calculated. This is compared with the actual precession of mercury to evaluate and determine the rationality and feasibility of the vortex gravitational mechanism.

Relevant data of mercury: the mercury precession is counterclockwise, the speed of mercury around the sun: 47.873km/s, its precession angle:

$$\varphi = 1^0 33' 20'' /100a = 1.5556^0 /100a = 5600'' /100a ,$$

its cycle around the sun:

87.98905d (earth day), The mercury perihelion distance: $5.791 \times 10^{10} m$.

4.1. Mercury Precession under Vortex Gravity

Set the Earth position vortex gravitational field strength in Section 3.1 to the vortex gravitational field strength in the Solar system:

$$B_g = 2.4566 \times 10^{-12} (t^{-1})$$

Let the vortex gravitational field strength at the position of the Mercury in the solar system be equal to that of the solar system Earth position, and the Mercury precession is calculated by the vortex gravity.

Mercury-orbit solar speed: $v = 47.8734 \times 10^3 m/s$

Mercury precession Angle is calculated with the perihelion distance as the radius. By formula (4):

$$a = vB_g = 47.8734 \times 10^3 \times 2.4566 \times 10^{-12} = 1.176 \times 10^{-7} (m/s^2)$$

Put the precession acceleration of Mercury into Equation (6), and the precession distance of Mercury in one year:

$$s_1 = \frac{1}{2}at^2 = \frac{1}{2} \times 1.1766 \times 10^{-7} \times (87.969 \times 24 \times 3600)^2 = 3.3966 \times 10^6 (m)$$

Mercury precession distance s_{100a} in 100 years of Earth:

$$s_{100a} = \frac{365.2422}{87.969} \times 100 s_1 = 415.19 \times 3.3983 \times 10^6 = 1.411 \times 10^9 (m)$$

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If the perihelion radius of Mercury is the perihelion distance of the orbit of Mercury, the precession Angle of Mercury is:

$$\theta = \frac{360^0 s_{100a}}{s_0} = \frac{360^0 \times 1.411 \times 10^9}{2\pi \times 5.791 \times 10^{10}} = 1.396^0 = 5025.6''$$

4.2. The Circular Motion Caused by Mercury's Precession

The formula (2) is: $\dfrac{v_1^2}{r_1} = v_0 B_g$

$$v_1 = \frac{s_1}{t} = \frac{3.3983 \times 10^6}{87.969 \times 24 \times 3600} = 0.4471 (m/s)$$

$$r_1 = \frac{v_1^2}{v_0 B_g} = \frac{(0.4471)^2}{4.7873 \times 10^4 \times 2.4451 \times 10^{-12}} = 1.678 \times 10^6 (m)$$

Cirferential radius of Mercury precession: $r_1 = 1678 km$

4.3. Discussion on the Precession of Mercury Caused by Vortex Gravitation and the Errors of Observations

In this paper, the Mercury precession is analyzed and calculated by vortex gravity,

Every 100 years of Mercury's precession angle $\theta = 1.396^0 = 5025.6''$, compared with the observed value $5600''$ of Mercury's precession, the deviation -10.26%, the vortex gravity produced the deviation of Mercury's precession which is close to the observed value 90%. It shows that the vortex gravity field in the solar system produces the vortex gravity to Mercury's motion, which is the internal fundamental reason of Mercury's precession.

Discussion on the error between the calculated value and the observed value of Mercury precession:

(1) The vortex gravitational field strength of the Earth's position is used as the vortex gravitational field strength of the Mercury precession to calculate the Mercury precession. Then, the accuracy of the Earth precession calculation determines both the vortex gravitational field strength of the Earth's position and the accuracy of the Mercury precession.

(2) Taking the vortex gravitational field strength at the earth's position as the vortex gravitational field strength of Mercury is based on the premise that the vortex gravitational field strength in the solar system is consistent. Therefore, the consistency of the vortex gravitational field strength in the solar system determines the accuracy of the calculation of Mercury precession value.

(3) The formation of the butterfly structure of the Milky Way should be the product of the motion of the Milky Way celestial bodies under the action of their vortex gravity. As a result, the solar system, as a part of the Milky Way, should also be affected by the vortex gravitational field of the Milky Way on a macro level, which should also be an important factor affecting the vortex operation law of the solar system planets. At the same time, the vortex gravitational field strength of the Milky Way can also be calculated through the operation of the solar system planets.

5. General Formula for Calculating Planetary Precession in the Solar System and Related Planetary Precession

5.1. General Precession Formula of Planetary Precession around the Sun

According to the above deduction, equation (6) can be extended to the precession distance formula of the solar system planets around the sun:

$$s = \frac{1}{2} v B_g t^2 \tag{6}$$

In the formula:

s — planet precession distance

v — Planet speed around the sun

B_g — vortex gravitational field strength of the Solar system

t — One cycle time of the planet around the sun

Since the above equation is the precession generated by the planet's movement around the sun, and the velocity generating precession is the planet's movement around the sun, it can be approximately regarded as being perpendicular to the vortex gravitational field strength of the solar system.

Precession angle of solar system planets:

$$\frac{\theta_1}{\theta_0} = \frac{s_1}{s_0} \tag{8}$$

In the formula:

θ_0: The planet orbits the sun at an angle of 360^0

θ_1: Precession angle of planets around the sun

s_0: One cycle distance (arc length) of the planet around the sun

s_1: The precession distance (arc length) of the planet under the action of vortex gravity is calculated by Formula (6)

Formula (6), (8) includes:

$$\theta_1 = \frac{s_1 \theta_0}{s_0} = 360^0 \times \frac{\frac{1}{2} B_g t^2}{2\pi r} \tag{9}$$

in the above formula: $B_{g,solarsystem} = 2.4578 \times 10^{-12} (t^{-1})$

r: The distance between the planet and the sun

v: Planet speed around the sun

t: One cycle time of the planet around the sun

5.2 The Precession Angle of the Solar System Planets

The precession angle of a planet around the sun can be calculated by substituting the relevant physical quantities of the solar system planets into Formula (9).

(1) Venus precession angle: $\theta_1 = 30.76''$

(2) mars precession angle: $\theta_1 = 94.08''$

(3) Jupiter precession Angle: $\theta_1 = 593.12''$

(4) Saturn's precession Angle: $\theta_1 = 1472.82'' = 24.547'$

6. Discussion on Vortex Gravitational Field

Gravitational field corresponds to electromagnetic field. The analogy of its structural form: universal gravitation corresponds to the static gravitation of positive and negative charges; Vortex gravitational field corresponds to magnetic field; Moving objects will be subjected to vortex gravity in the vortex gravitational field, which corresponds to the magnetic force effect of moving charges in the magnetic field.

6.1. The Force of Moving Objects in the Vortex Gravitational Field can be Determined by the Left Hand Rule

(1) Spread the palm straight, and form an angle 90^0 between the thumb and the four fingers;

(2) The gravitational line of vortex field passes through the palm;

(3) The four-finger direction is the moving direction of the moving object;

(4) The direction of thumb is the direction of vortex attraction of moving object;

(5) An object moving in the vortex gravitational field will be subjected to a counterclockwise rotating force from four directions to the thumb.

6.2 The Structure of the Vortex Gravitational Field

Vortex gravitational field strength and related structure analysis at Beijing, Paris and Earth positions.

The gravity field strength of the earth vortex at Beijing position calculated from the motion of Foucault pendulum:

$B_g = 2.469 \times 10^{-9} \left(t^{-1} \right)$

The gravity field strength of the earth vortex at the Paris position calculated by the motion of Foucault's pendulum:

$B_g = 1.6975 \times 10^{-9} \left(t^{-1} \right)$

The gravitational field strength of the space vortex at the earth's position calculated by the precession of the earth:

$B_g = 2.4566 \times 10^{-12} \left(t^{-1} \right)$

(1) Since the Foucault pendulums at Beijing and Paris and the precession of the earth move counterclockwise, it can be seen that the positions of Beijing and Paris and the space gravitational field of the earth moving around the sun all point from the north pole of the earth to the south pole of the earth.

(2) As the gravitational field strength of the earth in Paris is smaller than that of the vortex in Beijing, the gravitational field of the earth's vortex is similar to the annular structure of the magnetic field, and the gravitational field of the earth's vortex is also annular. Whether the gravitational field of the earth's north pole is opposite to that of Paris and Beijing. If this is true, Foucault pendulum will rotate clockwise near the North Pole.

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(3) Considering that the precession of the planets in the solar system is counterclockwise, the direction of the vortex gravitational field in the solar system is from the Earth's North Pole to the Earth's South Pole.

(4) Considering the correspondence and consistency between the vortex gravitational field of the solar system and the vortex gravitational field of the Milky Way, the direction of the vortex gravitational field of the Milky Way should be the same as that of the solar system.

(5) The silver center of the Milky Way should be the center of the Milky Way's strong vortex gravitational field, thus forming a strong vortex ring gravitational field structure of the Milky Way.

7. Vortex Gravity is the Power to Produce Atmospheric Cyclones

Vortex gravitation is the basic driving force of atmospheric cyclone. Several characteristics of atmospheric cyclones in the northern hemisphere show the effect of the earth's vortex gravity on atmospheric cyclones:

(1) Typhoon rotates counterclockwise in the northern hemisphere and clockwise in the southern hemisphere (Fong, Li, & Li, 1999).This is consistent with the precession mechanism of the Foucault pendulum under the action of the earth's vortex gravitational field. It is no accident that the rotation law of typhoons in the northern and southern hemispheres must have its internal dynamic mechanism and be determined by it.

(2) The frequent occurrence zones of tropical cyclones are concentrated in the $5^0 - 10^0$ latitude zone, while there are almost no tropical cyclones within the latitude 5^0 of the Northern and Southern Hemispheres. This should be related to the vortex gravitational field strength in this latitude zone of the Earth (Fong, Li, & Li, 1999).

(3) In the eastern Siberian region, there are cold anticyclones on the ground and cold cyclones on the upper air, with their centers nearly overlapping. Overseas in Kamchatka Peninsula. It is a nearly symmetric cold cyclone. However, it must be noted that this approximate symmetrical surface cold anticyclone and cold cyclone are not the same as this example. There are more approximate symmetrical cold cyclones in the adjacent areas on the same map than there are approximate surface cold anticyclones (Xie, Chen, & Xiao, 1959).

The appearance of such a reverse symmetric cyclone shows that in the polar region,

The earth vortex gravitational field has a ring structure similar to the geomagnetic field, which results in extremely complex atmospheric cyclones in the polar region.

(4) In the Arctic polar region, the frequency of Arctic Super Cyclone (ASC) accounts for about 1/3 of the total number. The frequency of external input and primary ASC in the polar region has no significant increase trend, but the frequency of long-term life history ASC increases at a rate of 0.49 times/(10 a), indicating that the duration of ASC is increasing (Ding & Huang, 2021). This shows that there is obviously a dynamic mechanism for the formation of atmospheric cyclones in the Arctic polar region.

There are also many examples with the characteristics of atmospheric operation under the action of vortex gravity, which will not be listed here. Vortex gravity is the force between moving objects, and it is the vortex force received by moving objects in the gravitational field. The formation of atmospheric cyclone in polar region must grasp the fundamental role of polar vortex gravitational field on polar region atmosphere, which is the basic driving force of atmospheric circulation, typhoon formation and operation.

8. Conclusion and Discussion

8.1. The Vortex Gravity Field B_g of the Solar System which Deduced from the Precession of the Earth is Valid

The application of vortex gravity mechanism to the operation unification of Foucault's pendulum precession, Earth's "precession" and Mercury precession in this paper is a discussion on the combination of vortex gravity mechanism theory with practice, a further demonstration of the correctness of vortex gravity theory, and a research on kinematics theory and celestial body operation theory. The gravitational field of the space vortex gravity in the solar system should be basically consistent $B_g = 2.4451 \times 10^{-12} t^{-1}$, or there should be greater consistency within the solar system. The vortex gravitational field strength value of the solar system's earth position determined by the Earth's "precession" is used as the vortex gravitational field strength value of the Mercury precession , and the Mercury precession is analyzed and calculated from this value. The error -10.26% is compared with the actual observation of Mercury. This deviation should also be analyzed and discussed from the solar system vortex gravitational field strength, Mercury's orbit, and related parameters.

Now people think that the precession value of Mercury is partly explained by the universal gravitation between planets, and the focus on the precession error of Mercury is part $43''$ of about 10% . This is a misunderstanding of the "Mercury precession", and it is a directional error in the understanding of the "Mercury precession". Due to the absence of the basic theory of vortex gravity, it can only be confined to the theoretical framework of universal gravitation. It is very far fetched to use the universal gravitation between celestial bodies to explain and calculate the "Mercury precession", and focus on the interpretation of a $43''$ precession of about 10% , which means that the understanding of the "Mercury precession" is to pick the sesame and lose the watermelon.

In the eastern Siberian region, there are cold anticyclones on the ground and cold cyclones in the upper air, which just shows that the circular gravity field of the earth is from the North Pole to the South Pole through outer space. The direction of the vortex gravity field on the ground of the North Pole is opposite to that of the vortex gravity field turning in the air, so the phenomenon of the opposite direction of the air flow on the ground and in the air is formed.

8.2. The Theory of the Vortex Gravity Field of Moving Objects Needs to be Builded

The butterfly structure of the Milky Way shows that there is a strong vortex gravitational field. The celestial bodies running in the vortex gravitational field of the Milky Way have the characteristics of

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precession. The vortex gravitational field of the solar system is closely related to the vortex gravitational field of the Milky Way. Several related concepts of vortex gravity theory: moving objects will produce vortex gravitational field; Vortex gravity is the force generated between moving objects, that is, objects moving in the vortex gravity field will be affected by vortex gravity; Motion is an inherent basic property of matter, so matter itself is a source of vortex gravitational field; Just as there is a gravitational energy field between objects, there is also a vortex gravitational energy field between moving objects.

Considering the symmetry of vortex gravity field and magnetic field generated by moving charges, the formula of vortex gravity field strength generated by moving objects can be established:

$$dB_g = k_g \frac{I_m dl \sin \theta}{r^2}$$, B_g is the vortex gravity field strength, k_g is the vortex gravity constant, and I_m

is the flow of moving objects. Therefore, it can be considered to measure the vortex gravitational field strength B_g and the vortex gravitational field constant k_g.

8.3. Focus on the Construction of New Theory

We should pay attention to the basic theory. The lack of basic theory will bring a series of serious problems to our understanding and research. Today, many people may think that our basic theory is relatively complete, and only some mending work is needed in the basic theory. However, the author believes that there are still many major problems in the basic theory (Yuan, 2015, 2016b, 2018). In the paper "A Study on current transmitted in conductors as displacement current" (Yuan, 2015), The problems existing in the basic theory of electromagnetism are put forward. Through the symmetry analysis of dynamics and electromagnetics, the relationship between charge momentum and charge kinetic energy in electromagnetics is proposed and established, the relationship between current velocity and voltage in the circuit is established, and the relationship between current velocity and current in the conductor is established by combining Ohm's law. The current in the conductor is transmitted in the form of displacement current, thus realizing the unification of current transmission mechanism in conductor and dielectric.In the paper "A study on fundamental theories of "tunnel effect" (Yuan, 2016b), The existing problems of the basic theory of quantum mechanics are put forward. According to the established relationship between charge momentum and charge kinetic energy (Yuan, 2015), the analysis of electron motion in the electric field shows that the "tunnel effect" is the result of problems in the basic theory and does not exist in practice. Quantum mechanics cannot violate the conservation of energy. In the paper "On Corresponding Between the 'Epochal Character', 'Stage' and 'Hierarchy' of Physical Theory and Evolution of Material Structure" (Yuan, 2018). It puts forward the corresponding dynamics between physical theory and the evolution of the universe, and has the characteristics of Epochal Character, stage and Hierarchy.

Considering that the Epochal Character, stage and Hierarchy of the general sense are used as the expansion of physical theory with the evolution of the universe and its dynamic expression. Therefore, The author adds double quotes to these three concepts. The basic theory should be paid attention to in

scientific research. It's very important to model the physical basic theory correctly. Generally speaking, some seemingly complex problems can be solved in general and regularly. To correctly understand Mercury precession, the first thing is to establish a correct "Mercury precession" operating mechanism. Vortex gravitational mechanism is a general theoretical construction of gravitational kinematics.

8.4. The Mechanism of Vortex Gravity is Complementary, Complete and Unified to the Theory of Gravity

In this paper, vortex gravity is used to unify the operation mechanism of Foucault's pendulum precession, Earth's "precession" and Mercury precession, and further demonstrate the rationality and effectiveness of the theoretical mechanism construction of vortex gravity. Vortex gravity theory is the theory of dynamic gravity of matter and the theory of kinematic gravity of objects. The construction of vortex gravity mechanism realizes the complementation, completeness and unity of static and dynamic state of objects in gravity theory.

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