The inertial principle is used to demonstrate the force source of space planets

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Abstracts According to the argument of general relativity that massive star distort space-time and make small ones circle around it, the moment of inertia, which integrates the mass property and the kinetic energy of distorting spac-time, is taken as the characteristic of planets, and the process of the growth of natural inertia motion of planets is demonstrated, it further shows that the source of planetary gravity comes from the inertial surge force spreading into space during the inertial moving of a planet, so that two or more planets get force each other, forming their own gravitational acceleration. Through the balance equation of inertia of the earth and the moon, the orbit of the earth around the moon is obtained with the moon as the frame of reference, and the gravitational acceleration value of the earth and the moon is calculated through the analysis of the two orbits of the Earth-Moon, the Sun-Earth. The value is basically consistent with the actual measured value, thus proving that the inertial force is the driving force for the motion of all planets.

Keyword Moment of inertia; Parallel axis principle; Equilibrium equation; Inertial surging force ; Acceleration of gravity

1 Introduction

After repeated arguments that gravity cannot be unified in theory and practice with strong, weak and electromagnetic forces, the general relativity first denies the existence of forces over a distance in theory (Zhao Zheng et al.,2012), and describes the distortion of space-time by massive objects and the movement of small objects according to the space-time. Light deflection experiments later confirmed the distorting of space-time (Ruan Xiaogang et al., 2019).The two elements of this view are the magnitude of the mass and the strength of the momentum that distorts space-time. Taking the moment of inertia, which combines mass properties and momentum, as the characteristic of a planet, it is considered that distorting space-time is an abstract explanation, Its essence is the inertial surging force that spreads into space during the inertial moving of a planet, so that two or more planets obtain the force on each other and form their own gravitational acceleration, which is manifested in the elliptical orbit (eccentricity) of the planet. Taking the Earth and Moon as examples, the corresponding equilibrium point of the two planets can be solved by the inertial balance equation, and the interactive equilibrium region of the two planets can be obtained, and the gravitational acceleration of the two are obtained and compared with those measured on the earth and the moon to verify their correctness.

2 The source of the force

According to the law of gravity and the equation of inertia moment, the corresponding gravitational force and inertial force are calculated, and the two are compared, so as to determine the source of the planet force. The analysis is carried out in a relatively simple lunar orbit (Liu Yanzhu *et al*., 2015), and the inertial force of the moon is first given:

As shown in Figure 1(The eccentricity of the elliptical orbits in the figure is correspondingly enlarged to facilitate the analysis of the main characteristics of the orbits, the following orbits diagrams all follow this method), the elliptic orbit of the moon can be logically divided into two parts. The first part is the circumference Lr given with the semi-minor axis b of the ellipse as the radius , which is the distance of the moon at a uniform motion and the speed is Vr.

The second part is the total circumference(Lt) of the ellipse, using LT-LR as the average acceleration distance, using (Lt-lr)/ T(the time of a cycle) is the average acceleration of the moon in orbit, see Figure1 , that is, the equivalent acceleration based on the speed of vr, denoted as Jm.

According to the data of the National Earth System Science Data Center of China (the distance unit is km, the mass unit is kg, the same as below): the average distance between the moon and the Earth is a=384,748, that is, the average semi major axis of the lunar elliptical orbit, b is the semi minor axis of the lunar elliptical orbit, and the eccentricities of the lunar orbit e=0.0549. According to the relationship between the semi major axis and the semi minor axis of the ellipse, then

$$a\text{-}b=a\text{-}a\sqrt{1-e^2} = a(1\text{-}\sqrt{1-e^2}) \text{ ,and } (1\text{-}\sqrt{1-e^2}) = 0.00150814,$$

T(The time of a lunar cycle)= 27.32(the number of days in a month)×86,164(the number of seconds in a day)=2,354,000.48 seconds, then

Jm=(ellipse circumference – circular circumference)/(The time of a lunar cycle)

=(Lt-Lr)/T

=((2πb+4(a-b))-2πb)/T

$=4\times a\times(1\text{-}\sqrt{1-e^2})/T$

$=(4\times 384{,}748\times 0.00150814)/2{,}354{,}000.48 = 0.988\text{m/s}^2$ (1)

and the other part from the solar and the Earth-moon orbit is given in section 6.

According to the equation of angular acceleration α and linear acceleration Jm, and a is the semi major axis of the lunar orbit, then the angular acceleration α of the lunar orbit is

α= Jm/a

According to the formula of inertial moment of the spherical rigid body (Cui Jinglei et al.,2021) and the principle of parallel axis of inertial moment (Yan Min et al.,2020), the moon(m) is set as an ideal spherical rigid body, $m=7.34\times10^{22}$kg, a =384,748km is the average distance between the moon and the earth, r=1,737km is the radius of the moon, α=Jm/a is the angular acceleration of the lunar orbit. Then the moment M and inertia force Fi of the moon to the Earth's centroid have the following equation:

M=Fi×a =(moment of inertia of m rigid body +m parallel axis inertial moment) ×α

$=(2mr^2/5+ma^2)\times\alpha$

$=(2mr^2/5+ma^2)(\text{Jm}/a)$.Its inertia force is

$Fi=(2mr^2/5+ma^2)(\text{Jm}/a^2)$

$=((2r^2)/(5a^2)+1)\times m\times \text{Jm}$

$=7.32\times10^{22}$ N

The gravity of the Earth to the moon is given seconly: according to the law of universal gravitation, the mass of the Earth $=5.96\times10^{24}$, the mean distance from the moon to the Earth is S=384,748,000m, and the gravity Fn of the Earth to the moon is:

Fn= Gravitational constant × mass of the Earth × mass of the Moon $/(S)^2$

$=6.67\times10^{-11}\times7.34\times10^{22}\times5.96\times10^{24}/(384,748,000)^2$

$=1.97\times10^{20}N$

This value is the part of the gravitational acceleration of the moon in the Earth and Moon system, Compare Fi and Fn

$Fi/Fn=(7.32\times10^{22})/(1.97\times10^{20})=371$

The force of inertia is 371 times the force of gravity, and it is clear that the Earth cannot hold the moon by gravity. So how did such a large force of inertia form, and how did the moon balance with the Earth in space?

Starting from the natural inertial evolution and growth process of a planet, we can explain the source of the force on the earth and the moon, Using space as frame of reference and excluding gravity:

Micro-matter (as long as it is an object with mass)→ internal imbalance (uneven distribution)→ natural tilting towards the heavier side (formation of moment of inertia)→ uneven density of the space medium causes the object to rotate naturally and achieve relative equilibrium at speed (inertial surging force generated by the motion orbit and spreads into space)→ inertial surging force generated in space (associated with other objects through the force) → Two (or more) objects generate corresponding acceleration through the inertial surging force of each other (the orbit forms an ellipse, and the gravity of the planet comes from the acceleration given by the elliptical orbit(Liu Lin et al.,2007)→the acceleration froce gradually hold multiple objects into one (increasing the mass at the same time, that is, increasing the inertia)→ the greater the inertia, the more the inertial force, the tighter the pressure until glowing(Star formation)→... .

Space objects, including the Earth, grow gradually and naturally, and the moment of inertia marks the main property of planets, not only the mass of object but also the ability to momentum. The inertial forces are generated because of the internal and external imbalances of planets. Taking space as the frame of reference, as the internal imbalance object will naturally rotate ,while the environment imbalance object will naturally revolute , it moves naturally by its own inertial force with external inertial surging force .

For example, The internal imbalance that has always existed has evolved into the present mass imbalance in the upper and lower hemispheres of the Earth (bounded by the Earth's axis of rotation) (Hao Liang, et al.,2017).

K= (the Angle between the Earth's rotation axis and its orbital plane)/(the remaining Angle of this Angle)

$=66.56/23.44=2.839$

The space imbalance (inertial surging force generated by various planets in space) gradually evolved into various orbits of the solar system today.

Internal and external disequilibrium is a property of the object and the environment, and the object that natural inertial moving uses speed to maintain a relative balance. The following is the equivalent transformation of the planet orbit, which is convenient for standardized calculation. And then the gravity (acceleration) of the earth in the Earth-moon system is obtained with the inertial balance equation of the earth and the moon.

3 Equivalent transformation of planet orbits

A ccording to Kepler's second theorem, the elliptical orbit of the planet is equivalent transformed, and the calculation intensity of the elliptical orbit from the focal point to the far point and the near point is equivalent to calculate only the average point, so as to reduce the calculation intensity by half.

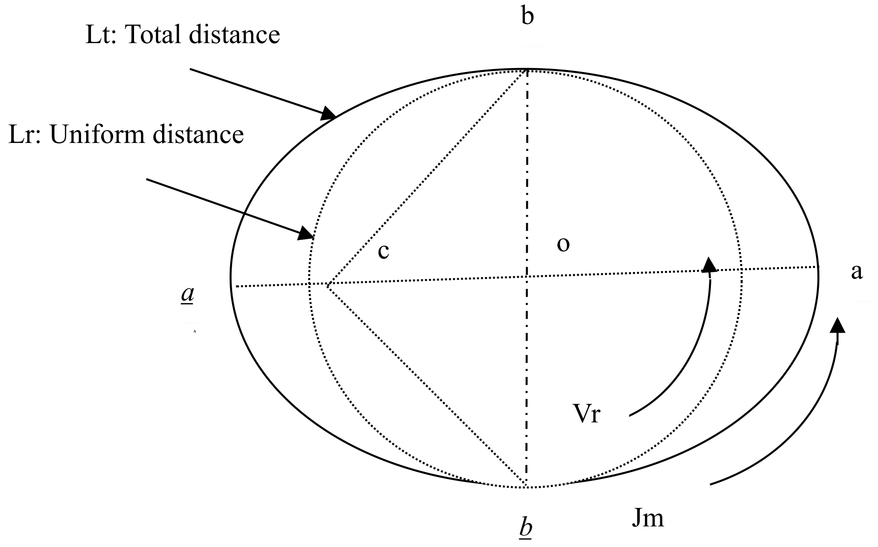

Figure 1. The Schematic diagram of the Moon's orbit

Take the elliptical orbit of the moon as an example, see Figure 1. The semi-major and semi-minor axes of the orbit are a and b, respectively, and the distance between the focal point and the midpoint o is c. The area covered by Lt is divided into fast and slow areas. The fast area is the area covered by c b *a* *b* and c, denoted as △1; The slow area is the area covered by c b a *b* and c, denoted as △2.The delta region is the area covered by c b *b* and c, denoted as △.

According to Kepler's second theorem, the area swept by the moon in the orbit relative to the focus in unit time is the same, and the area in the △1 is relatively small, so the moon will be relatively accelerated in the △1 of Lt orbit, the fastest point is a; The area of the △2 is relatively large, so the moon is relatively slow in the Lt orbit, and the slowest point is a. If the total area is S, there is

$$S=(a\times b)\times\pi;\ \triangle=((2b)\times c)/2=b\times c;\ \triangle1= S/2-\triangle;\ \triangle2= S/2+\triangle.$$

If the time taken to sweep the area of △1 is T=t, it follows from Kepler's second theorem,here is

$$(\triangle1=\triangle2)\ |T=t \rightarrow(S/2-\triangle= S/2+\triangle)\ |T=t \qquad (2)$$

As long as △ is within the elliptic orbit of the planet, the formula (2) is valid regardless of how △ is chosen within that range. To equivalent transform the eccentric elliptical orbit of the moon in Figure 1 to an uneccentric elliptical orbit in Figure 2, △ in equation (2) is set to 0, that is, c=0. The specific method is to translate the center point o of the ellipse to the focal point c, and a is the average distance between the far point and the point near in the Moon orbit to the Earth. In this way, the area swept by the moon traveling on an equivalent elliptical orbit in unit time with o point as the center in Figure 2 is the same and the relevant calculation is also consistent with the reality.

4 Equation of inertia balance of two planets

Let the masses of the two planets be m and M, the distance between the two centroid of M and m be p, and the distance between the centroid of M and m to the equilibrium point be H and h respectively, p=H+h. According to the moment of inertia formula of the real rigid sphere(Cui Jinglei et al.,2021) and the principle of parallel axis of moment of inertia (YAN Min et al.,2020), the equilibrium equation of the two planets is as follows:

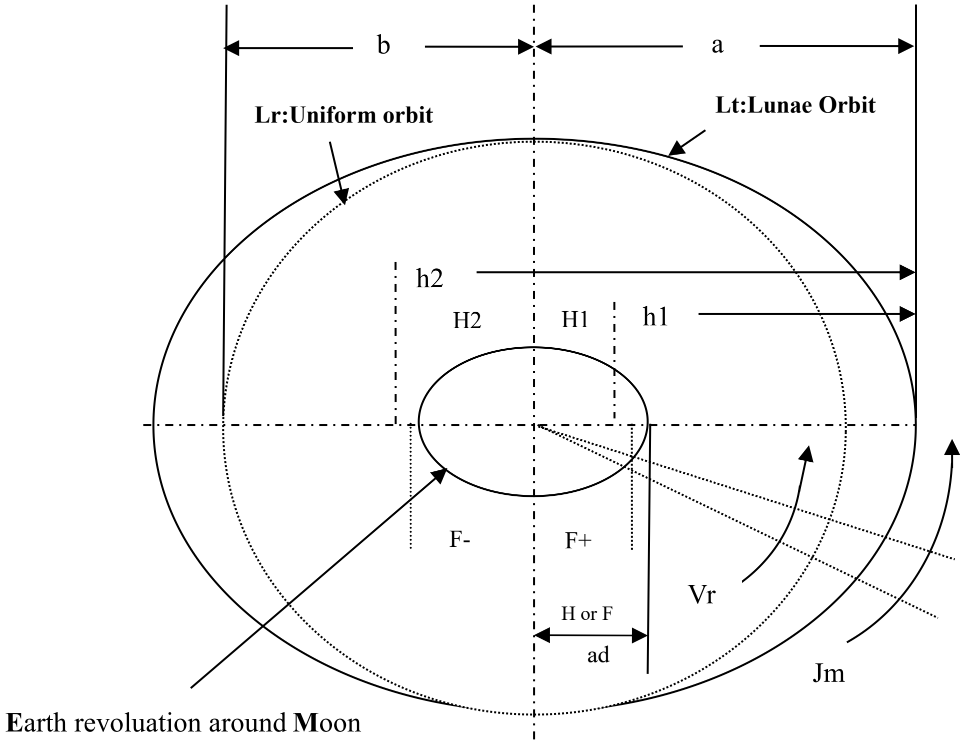

Figure 2. Shematic diagram of the Earth and Moon system

(IC+IH)T×J=(ic+ih)t×j

Where IC and ic are the moment of inertia of a spherical rigid body of M and m to its own center of mass;

IH and ih are the moment of inertia of parallel axes from the center of mass of M and m to the equilibrium point.

T and t are respectively the rotation angles of M and m in a given period;

J and j are the Angle functions of the rotation axis of M and m to the normal of The plane respectively, this plane is the orbital plane between the Earth and the Moon.

Substituting variables has

$$2MR^2/5+MH^2=(2mr^2/5+mh^2)t\times j/(T\times J)$$

Equivalent substitution known relationship value to reduction of the equation, namely, M = x× m, R = y ×r, z=(t×j)/(T×J) and expand the equation $h^2 = (p - H)^2$:

$$2(x\times m)(y\times r)^2+5(x\times m)H^2=2m\times r^2z+5m\times z\times(p^2-2pH+H^2)$$

After reduced m and expanding the parentheses, merge the items to get :

$$5(x-z)H^2+10z\times p\times H+2(x\times y^2-z)r^2-5\times z\times p^2=0 \quad (3)$$

Coefficients of the quadratic equation with one variable has

$$a=5(x-z); \quad b=10\times z\times p; \quad c=2(x\times y^2-z)r^2-5z\times p^2. \quad (4)$$

This is the equation for the equilibrium of the two planets.

5 Gravitational acceleration of the Earth in the Earth-moon system

Let M and m be the masses of the Earth and the moon, H and h are the distances from the center of the Earth and the moon to the equilibrium point, and p(the average distance between the earth and the moon)=H+h.

Since one cycle in the Earth-moon system is 27.32 days, the earth and moon rotate 27.32×2π and 1×2π respectively, as shown in Figure 3, then

T=27.32×2π, t=1×2π

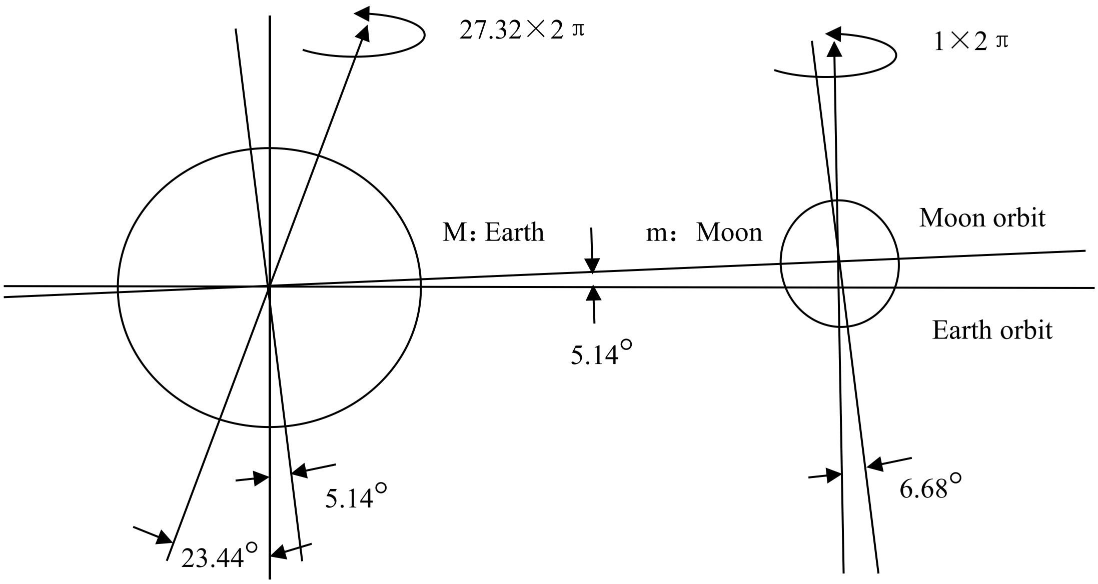

Figure 3. The parameters of the Earth and moon system

The straight-line distance between the Earth and the moon forms the orbital plane of the moon rotating around the Earth ,and the angles of the Earth's and the moon's spin axes to the plane's normal are 28.58°(23.44+5.14) and 6.68°, As shown in Figure 3,Since these two axis of rotation are at the hypotenuse of the function cos ,there is

J=1/ cos(28.58°), j=1/ cos(6.68°) Then

z=(t×j) / T×J =2π×cos(28.58°)/ (27.32×2π×cos(6.68°)

=(cos(28.58°)/(27.32×cos(6.68°))=0.03236.

The known ratios of the Earth to the Moon's mass is M= 81.3m and the known ratios of the Earth to the Moon's radius is R= 3.66r, while the moon's radius r=1,737 and the mean distance between the Earth and the moon p=384,748. If the above proportional data x=81.3 and y=3.66 are substituted into equation (4), then:

a=5(x-z)=5×(81.3-0.03236)=406

b=10×0.03236×384748=124,504

$c=2(81.3\times(3.66)^2-0.03236)(1,737)^2-5\times0.03236\times(384,748)^2$

= -17,379,843,602

Solve the quadratic equation with one variable and calculate the parameters

$\triangle$=b^2-4ac

=$(124,504)^2$-4×406×(-17,379,843,602)

=15,501,246,016+28,240,367,255,664

=28,240,367,255,664,then

$\sqrt{\triangle}$=5,314,166

The solution of equation (3) is the equilibrium distance of inertial force of the Earth relative to the Moon, where

H1,2=(-b±$\sqrt{\triangle}$)/2a , solve it

H1=(-b+5,314,166)/2a=6,391

H2=(-b-5,314,166)/2a=-6,697

See Figure 2. H1 and H2 give the positive and negative equilibrium ranges of the equilibrium trajectory when the earth revolves around the moon. According to the principle of finding the average value in sections 3, the average value of H1 and H2 is the semi-major axis of the equilibrium trajectory when the earth revolves around the moon., denoted h, with

H=(|H1|+|H2|)/2=(6,391+6,697)/2=6,544

the equilibrium distance of inertial force of the Moon relative to the Earth is

h1=p-H1=384,748-6,391=378,357

h2=P-H2=384,748-(-6,697)=391,445

The value of the balance ratio of the moon to the earth

k1=h1/H1= 378,357/6,391 =59.2

k2=h2/H2=391,445 /(-6,697) =-58.4

The semi-major axis of the lunar orbit gives the positive and negative semi-major axes of the Earth's elliptical orbit around the moon (with the moon as reference) at these ratio.

F+=384,748/k1=384,748/59.2 =6,499

F-=384,748/k2=384,748/(-58.4) = -6,588

See Figure 2. According to balance ratio(K1 and K2), F+ and F- give the positive and negative ranges of the Earth's revolution around the Moon, and according to the principle of averaging in section 3, the average value of F+ and F- is the semi-major axis of the Earth's revolution around the Moon, which is denoted as F, yes

F=(|F+|+|F-|)/2=(6,499+6,588)/2=6,543.5

F is the average semi-major axis of the Earth’s revolution the Moon.

As shown in Figure 2, since the revolution of the lunar orbit is synchronized with its rotation(Liu Yanzhu *et al*., 2015), that is, the size of the orbit of the revolution and the rotation is the same, the Earth’s orbit around the moon has to be synchronized with the moon’s orbit according to the principle of inertial equilibrium, so the revolution orbit of the Earth around the moon is also the same size as its rotational orbit. Let the semi-major axis of the Earth’s rotation orbit be ad when the Earth revolves around The Moon, then there is ad=F. From the above analysis and calculation, it can be seen that’s the revolution orbit of the Earth around the Moon completely overlaps with the equilibrium orbit of the Earth and the Moon, and the sami-major axis of the Earth’s revolution around the Moon is equal to the sami-major axis of Earth’s rotation. Figure 4 is an enlarged view of the Earth’s orbit around the Moon in Figure 2.

As shown in Figure 4, ad is not only the length of the semi major axis of the ellipse of the revolution orbit but also the length of the semi-major axis with 27.32 rotations in one month. In one month, there are 27.32 ad rotation orbits with ad length as the semi-major axis, and 27.32/2=13.66 ad rotation with ad length as the semi-major axis in a half cycle. That is ,According to the equivalent proportional relationship of this revolution ,the acceleration of one revolution period of the Earth is 13.66 times that of one rotation period, and let the ratio of revolution K=13.66,bd be the semi-minor axis. See Figure 4(only the equivalent diagram of the half-revolution period is given here, and the other half cycle corresponds to it)

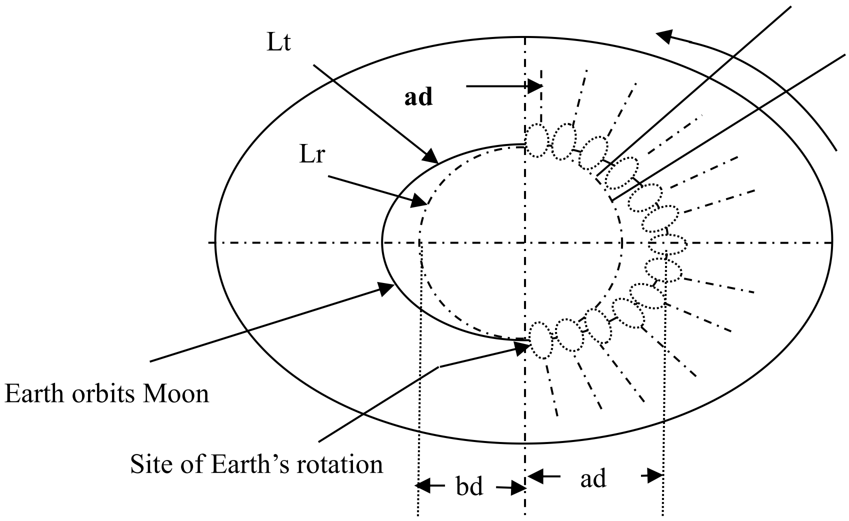

Figure 4. Equivalent diagram of the Earth's orbit around the Mooon

See also how to find the acceleration of the Moon, T is the number of seconds of the earth's around the moon in a rotating cycle (=8,6164), the eccentricity of the Earth's revolution and rotation around the moon is the same as the lunar orbit, it is e=0.0549, and (1- $\sqrt{1-e^2}$) =0.00150814, the ratio of revolution is K=13.66,the average acceleration of the Earth's around the moon in a revolution cycle, can be obtained from Figure 4:

Je= ((2π×bd+4×(ad-bd))-2π×bd)×K/T

=4×(ad-bd)×K/T=4×ad×(1-$\sqrt{1-e^2}$)×K/T

=4×(6,543)×0.00150814×13.66/8,6164

=6.25m/s^2 (5)

This value is only the gravitational acceleration of the Earth in the Earth and Moon system.

6 Orbit of the Earth-Moon system with respect to the Solar system

Relative to the Solar system, it provides relevant data about the Earth relative to The Sun, where the average distance between the Earth and the Sun is 149597870km, which is the semi-major axis of the elliptical orbit. Orbital eccentricity e=0.0167, after calculation 1-$\sqrt{1-e^2}$=0.00013945, See how to calculation method for the acceleration of the moon or the earth, the acceleration of the solar system to the Earth is

Js=4× (The circumference of elliptical orbit - The circumference of circular))/ (days of a year × seconds in one day)

=(4×149,597,870×0.00013945)/((365.2422 × (86,164))

=2.6515 m/s^2

This acceleration and Je given by equation (5) are superimposed, and the average gravitational acceleration of the earth after superimposed:

$$Jes=Je+Js = 6.25m/s^2 + 2.6515m/s^2 = 8.9015m/s^2 \qquad (6)$$

In the Earth-Moon system, the interaction between the two orbits is corresponding, so is the interaction between the acceleration of the two, and the acceleration of the Moon in the Earth-Moon system is given as Jm by equation (1). The ratio of the acceleration of the earth and the moon in the Earth-Moon system kt(=Jm/Je) can be used to find the acceleration increment of the Sun to the moon ,calculated as follows:

$$J\triangle=Js\times kt=2.6515\ m/s^2\times(Jm/Je)$$

$$= 2.6515\ m/s^2\times(0.988/6.25) =0.419\ m/s^2$$

The gravitational acceleration of the moon in the Earth-moon system given by equation (1) is Jm, then the average gravitational acceleration of the moon after superposition is:

$$Jms=Jm+J\triangle=0.988+0.419=1.407\ m/s^2.$$

7 Conclusions

The three problems are given conclusive explanations such as the difference between the calculated acceleration value and the measured acceleration value, the effect on the equivalent average acceleration and the actual gravitational acceleration, and the effect on the inertial surging force.

7.1 The difference between the calculated acceleration value and the measured acceleration value

The difference between the actual gravity acceleration value measured on the Earth or the Moon and the calculated Jes or Jms is:

$$9.80\ m/s^2- Jes=9.80-8.90=0.9\ m/s^2;1.62\ m/s^2- Jms=1.62-1.407=0.213\ m/s^2$$

Except for minor error caused by the data, the difference should come from the Solar system in upper layer, similar to the Earth-Moon system's orbit is guided by the Solar inertial surging force, and the acceleration of the Earth's orbit around SUN is superimposed on the Earth and also on the Moon in proportion. So the acceleration of the Sun's orbit around GALAXY will also be proportionally superimposed on the Sun and the Earth and its Moon. However, according to the equilibrium conditions of the inertial system, the orbital eccentricity of the galaxy of upper system must be less than the eccentricity of this, such as the Earth-moon orbit and the Sun- Earth orbit of upper layer. Because the higher the mass and moment of inertia of the upper galaxy (body), the more stable the orbital eccentricity, the smaller the orbital eccentricity. According to the proportional relationship between the moon, earth and sun, the more superimposed layers, the smaller the superimposed gravitational acceleration of the lower layer will be obviously. Therefore, the gravitational acceleration from the upper layer (The Solar-GALAXY systems) should be less than the gravitational acceleration of The solar and Earth-moon systems (2.6515 m/s^2), which is basically consistent with the actual measured value.

7.2 Equivalent average acceleration and actual gravitational acceleration

Suppose Figure 2 is an equivalent elliptical orbit of the moon, and the average acceleration of the moon in one cycle is Jm =(Lt-Lr)/(Time of a cycle), which is an acceleration based on the speed Vr.

Kepler's second law (Zhao Xianjue et al.,2017), is expressed in the conservation of angular momentum , The areal velocity V of a planet is constant in its orbit. If dS is the increment of area at the incremental time dt, and a is the areal acceleration at the incremental time dt, then there is

$V=dS/dt$, $a=dV/dt= d^2S/dt^2$

According to the equivalence relation, obviously there is

$Jms=a$

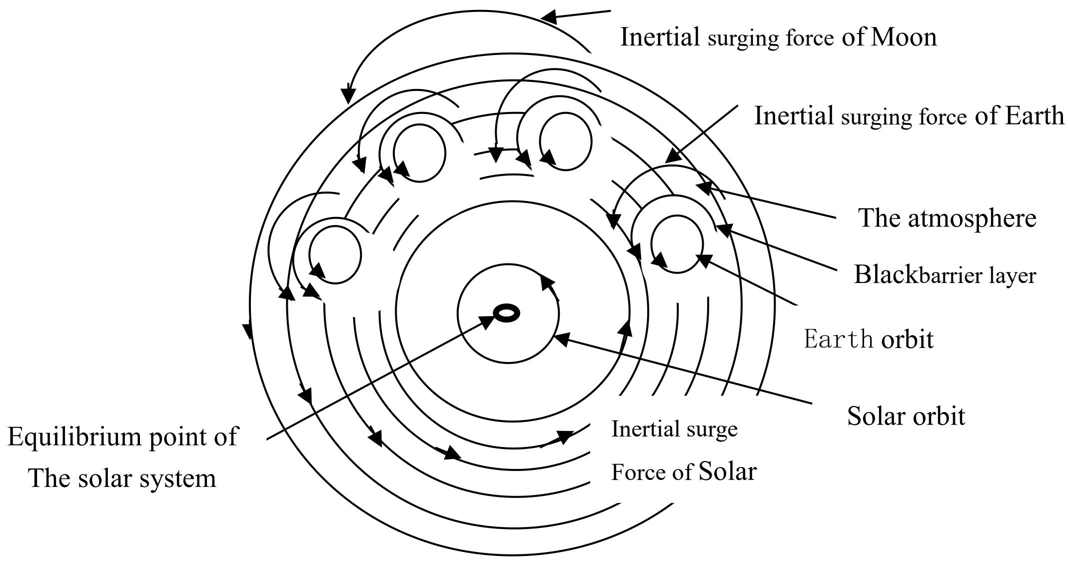

Figure 5 Diagram of the inertial surging forces of the Sun and the Earth and its Moon

The same is true of the Earth's equivalent acceleration Jes. This proves that the equivalent trans formation of planet orbits is correct in section 3, and the calculated equivalent acceleration of the earth and the moon is exactly equivalent as the gravitational acceleration measured on the earth and the moon, that is

g(Earth's acceleration of gravity)=Jes, gy(Moon's acceleration of gravity)=Jms

That is, the Earth, which conserved angular momentum in orbit, is naturally accustomed to achieving its (equivalent) acceleration of gravity by traveling faster and slower. This change in velocity is so small relative to the Earth's inertial velocity that it will have little effect on small mass objects on the ground (such as human activities), but it will have an effect on large mass objects on the ground, such as tide phenomena occur when The Earth is moving near the semi-minor axis of its elliptical orbit.

7.3 Effects of inertial surging force

The Einstein ring, which has deflection on light in the solar extension, and the black barrier layer called the atmosphere in the Earth extension(Ye H L et al.,2022) are essentially relatively fixed spatial inertial surging formed by them emitting inertial surging forces. Figure 5 shows the inertial surging forces of the sun, the Earth and the moon.

The black barrier layer in the atmosphere(Liu W et al.,2024) is a combination of the inertial surging force of the Earth during rotation and inertial surging force of the Solar system's along a surging rotating flow. Since the direction of the rotational force is the same as that of the inertial surging force of the Solar and the Moon, it is only a inertial surging force strengthened by the inertial force of the Earth, as shown in Figure 5. The black barrier layer is a large force effect layer generated at the intersection of the Solar inertial surging force and the Earth inertial surging force.

The formation of the atmosphere (including the black barrier layer) grows synchronously with the inertial growth of the Earth, and the black barrier layer is equivalent to a high-density inertial force shell of the earth's inertial force extension. Because the Earth's surface is always relatively stable under the Sun's inertial surging force and the atmosphere (especially the black barrier). The earth's inertial surging force is centered on the earth's rotation axis, with the greatest equatorial extension and the least polars extension. Therefore, recycled satellites are theoretically launched in the direction of the Earth's rotation near the equator to save energy by the help of the Earth's inertial surging force, whereas theoretically recycled near the poles can reduce the interference of the black barrier. That is, the atmosphere (inertial surging) is the transfer of momentum through the space medium when the earth is moving inertially, so the atmosphere (especially the black barrier) is dynamic rather than static.

The above three conclusions can be generalized to the analysis of various bodies in the Solar system.

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