Kepler's constant in Earth-Moon System is gradually decreasing

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Abstract

Studies on nautiloids, coral fossils, rotation of the Earth, and Earth-Moon distance variation may lead to a conclusion that Kepler's constant is decreasing in the system with the Earth as the central celestial.

Keywords: Nautiloids, Earth-Moon Distance, Kepler's Constant, Vortex

1. Introduction

In his *The Harmony of the World*, Kepler introduced the planet motion law, namely Kepler's Third Law. This Law indicates that with the Sun as central celestial, the ratio of the cubic of planet orbit radius (R) to the square of the period of orbit (T) is a constant, namely $\frac{R^3}{T^2}$ =C. It can be deduced from the Universal Gravitation Formula that C=$\frac{MG}{4\pi^2}$, so Newton believed this constant is only related to the mass of the central celestial. In *Newton's Formula of Universal Gravitation is Just Kepler's Third Law*, I presented proofs in detail and believed that Newton copied Kepler's Third Law, but only added some meaningless definitions at will. MG has no physical meaning.

MG only replaced $4\pi^2C$ in Kepler's Third Law (extended Third Law), so it was very wrong to represent the value of Kepler's Constant by $C=\frac{MG}{4\pi^2}$.

We can deduce $MG=4\pi^2C$ from $F=G\frac{M\cdot m}{R^2}$.

But what is the specific process to deduce $MG=4\pi^2C$ from $F=G\frac{M\cdot m}{R^2}$? What is the physical meaning? To understand these questions, we should first know how Newton's Universal Gravitation Formula was from.

Table 1	
Kepler's Third Law is Newton's Formula of Universal Gravitation	
Steps	Deduction
1	$\frac{R^3}{T^2}$ =C can be expanded to $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$. The specific expansion and deduction are illustrated in *Newton's Formula of Universal Gravitation is Just Kepler's Third Law*. $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ is completely transformed from $\frac{R^3}{T^2}$ =C. The two formulas are the same, because $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ is still Kepler's Third Law. It's only an expanded format from Kepler's Third Law. (R is average orbit radius of planets, T is orbital period, C is Kepler's constant, m is mass of an object, V is average linear velocity of planet orbits, and a is centripetal acceleration).
2	$m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ is equal to $F=\frac{4\pi^2C\cdot m}{R^2}$, because Newton replaced m·a by F (the meaning of F is still m·a, mass multiplied by acceleration).
3	Then based on the logics in Step 2, $F=\frac{4\pi^2C\cdot m}{R^2}$ is equal to $F=G\frac{M\cdot m}{R^2}$,

	because Newton replaced $4\pi^2C$ by MG. (the meaning of MG is still $4\pi^2C$, namely $4\pi^2C$ multiplied by C, rather than mass multiplied by constant as Newton believed, so the pair of letters MG has no physical meaning).
4	From the deduction in the above two steps, it is evident that $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ is equal to $F=G\frac{M\cdot m}{R^2}$.
5	Since $\frac{R^3}{T^2}$ =C is equal to $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$, $\frac{R^3}{T^2}$ =C is also equal to $F=G\frac{M\cdot m}{R^2}$. So Kepler's Third Law and Newton's Formula of Universal Gravitation are the same.

From the deduction in the table above we can see that, Newton replaced $4\pi^2C$ in $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ by MG (note: $m\cdot a=\frac{4\pi^2C\cdot m}{R^2}$ is just Kepler's Third Law, because it is an extended form), then the physical meaning of MG is still $4\pi^2$ multiplied by C, rather than what Newton fabricated as "mass multiplied by constant". This is exactly like to replace m·a by F, but F still means mass multiplied by acceleration. F is only a letter that replaces m·a, so we can use any letter else. For instance, if we use SG to replace m·a, namely SG=m·a, then even we use two letters SG, their meaning is still m·a (mass multiplied acceleration). But we should never endow SG with a fictitious physical meaning as what Newton did. For instance, if we define S as "displacement" and G as a constant with unit, then the two sides of the equation are conflicting in physical meanings. The left side means displacement multiplied by a constant, but the right side means mass multiplied by acceleration. Readers will think it absurd to fabricate a physical meaning, but this is what proved that Newton copied Kepler's Third Law and fabricated a physical meaning.

In $C=\frac{MG}{4\pi^2}$, MG originally means $4\pi^2$ multiplied by C, so if we substitute $4\pi^2C$ into $C=\frac{MG}{4\pi^2}$, then $C=\frac{MG}{4\pi^2}$ is immediately changed to C=C. This is exactly what Newton did, because he explained the value and meaning of C by C. This is really wrong. So the view that "The value of Kepler's constant is related to the mass of central celestial" was also fabricated by Newton and was absolutely undependable.

In general, neither theories nor real observations can provide evidence that Kepler's Constant is fixed. Therefore in this paper, two questions will be discussed: first, whether Kepler's Constant is changing in a system with Earth as central celestial; second, the analogy between vortex system and celestial system.

2.1 Conclusions from vortex experiments

In *Vortex and Kepler's Third Law*, we analyzed and discussed the relationship between a vortex's orbit radius and the period of orbit and obtained three conclusions.

1， The orbit of a vortex is usually elliptic.

2， For a section of a vortex, the ratio of the cubic of orbit radius to the square of the period of orbit is a constant, namely $\frac{R^3}{T^2}=C$. The value of this constant is related to the size of the vortex. A larger vortex produces a larger K.

3， Analysis on the first section of a vortex shows that C=212; analysis on the second section of the vortex shows that C=55. The two sections were sampled at a time interval of 8.44 s, but the two constants differ nearly 4 times. Within a unit time, the first vortex sample has higher energy and higher average revolving speed, so its constant is larger. Within a unit time, the second vortex sample has lower energy, so its constant is smaller. But from the whole vortex of 44 s, this constant is gradually decreasing and finally disappears when the vortex returns to quiescence. In general, for the whole water vortex, from when it starts to when it finally returns to quiescence, the vortex constant is gradually decreasing with the passage of time.

2.2 Partial analogy between vortex and Earth-Moon System

In comparison of the natures between vortex system and celestial system, the first two conclusions are certainly consistent, but how to explain the third one? In the third conclusion, for a complete water vortex, from when it starts to when it finally returns to quiescence, the vortex constant is gradually decreasing with the passage of time.

According to the existing theories, however, in a celestial system when the central celestial is fixed, the Kepler's constant ($\frac{R^3}{T^2}$ =K) that corresponds to the central celestial is fixed, so Kepler's constant won't change with time, let alone gradually decrease. Why vortex system and celestial system are different in the third conclusion? Is Kepler's constant always unchangeable?

3.1 Part of achievements from studies on Earth-Moon System

In the Earth-Moon System that we are most familiar with, we now analyze if Kepler's constant is unchangeable or gradually decreasing in the system with the Earth as central celestial.

On October 19 1978, *Nature* published "*Nautiloid growth rhythms and dynamical evolution of the Earth-Moon system*", jointly written by Stephen M. Pompea and Peter G.K. Kahn. Through skillful studies they discovered that the Earth-Moon distance is not unchangeable, but the Moon is getting away from the Earth with the passage of time.

They investigated 90 individuals and 40 chambers from a recent nautiloid species, and discovered that the wave-like fine lines on shells showed some nature of tree growth rings. Between chambers, the number of growth lines was about 30, which is consistent with a modern lunar month (29.5 days). Modern nautiloids grow a cycle of wave-like lines per day and a chamber each month. This special phenomenon greatly inspired the two geographers. Then they studied 36 ancient nautiloid fossils, including 2 Neozoic fossils, 8 Mesozoic fossils, and 26 Paleozoic fossils. The results show that the number of growth lines between two chamber plates in ancient nautiloids was decreased as dated back, but was constant among fossils of the same age. The number of growth lines on a shell was 26 in Neozoic Oligocene, 22 in Mesozoic Late Cretaceous, 18 in Mesozoic Jurassic, 15 in Paleozoic Carboniferous, and 9 in Paleozoic Ordovician. The authors then supposed that in the end of Ordovician, the Moon revolved the Earth only in 9 days.

After we know the Moon's orbiting period, the Earth-Moon distance can be calculated from Kepler's Third Law. The result shows that the Earth-Moon distance 400 Myr ago was only 43% of that today. They further calculated the Earth-Moon distance 69.5 Myr ago to be 0.840 of that today, which implies the average recession in the lunar orbit semi-major axis was 94.5 cm yr^{-1}, namely the average speed for the Moon to depart from the Earth is 94.5 cm yr^{-1}. This figure was calculated by using Kepler's Third Law. The result is the same whether we use the Earth-Moon Kepler's constant 69.5 Myr ago or today. But why? Because modern physics believes that Kepler's constant will not change with time.

It has been long believed that "for the same central celestial, its Kepler's constant won't change with time", which has been used for long, and seldom or never been suspected. The bases that support this conclusion are some purely theoretical and mathematical deductions. This conclusion hasn't been validated by any observation.

In order to understand the issue of Kepler's constant, we first list and compare five important achievements on Earth-Moon System at different ages.

1) Stephen M. Pompea and Peter G.K. Kahn calculated from nautiloids that the Earth-Moon distance 69.5 Myr ago was 0.840 of that today, which implies the average recession in the lunar orbit semi-major axis was 94.5 cm yr^{-1}, namely the average speed for the Moon to depart from the Earth is 94.5 cm yr^{-1}.

2) According to documented calculations in 3000 years through eclipse observations, the average speed for the Moon to depart from the Earth is 5.8 cm yr^{-1}.

3) Laser ranging technology shows that the Moon is departing from the Earth at 3.78 cm yr^{-1}.

4) Corals also have "growth ring". Corals nowdays produce 365 cycloids per year, but coral fossils 400 Myr ago grew 400 cycloids per year. This indicates that 400 Myr ago, the Earth had 400 days per year, and it rotated every 21.5 hours, which was 2.5 hours quicker than today.

5) Since leap second was introduced in 1971, UTC has been adjusted 25 leap seconds. In fact, since atomic time was introduced in 1958, the two timing systems have generated an accumulated gap of more than 33 s. This indicates that during the past 50 years, the rotation of the Earth has been slowed down more than half a minute. This indicates from the perspective of atomic clock that the rotation of the Earth is slowing

down.

3.2 Analyses on the five achievements above (about the changes of Kepler's constant)

In the first and the second achievements, the Moon is departing from the Earth at an average speed of 94.5cm yr-1 and 5.8cm yr-1 in respectively. Why would these two results so different? There is no answer yet. In the third achievement, the Moon is departing from the Earth at an average speed of 3.78 cm yr^{-1}, which is calculated by precise laser ranging technology and thus should be very accurate. But why is it so different from the first two results? There is only one truth. What can explain such big difference?

We first select the most dependable result. In the first achievement, the Moon's orbiting period (lunar month) deduced from nautiloids should be very reliable. One lunar month 69.5 Myr ago had 21.034201 days. In the third one, the Moon is departing from the Earth at an average speed of 3.78 cm yr^{-1}, which was calculated by precise laser ranging technology and thus should be very dependable.

So will there be such a possibility that from 69.5 Myr ago to now, the Moon is departing from the Earth at an average speed of 3.78 cm yr^{-1}? Then we can obtain the Earth-Moon Distance 69.5 Myr ago was 381772900 m. Studies on nautiloids show that 69.5 Myr ago, the Moon's revolution period was 21.034201 days. Then we can find the Kepler's constant with Earth as center 69.5 Myr ago was $C=\frac{R^3}{T^2}$, $C=16.941505\times10^{12}$ (m^3/s^2). Then we can find today's Kepler's constant with Earth as center is $C=10.250019\times10^{12}$ (m^3/s^2). Therefore, Earth-Moon System's Kepler's constant ($\frac{R^3}{T^2}=C$) 69.5 Myr ago was greatly larger than today. (Research on coral fossils shows that 400 Myr ago, the Earth rotated a cycle at 21.5 hours. In this way, 69.5 Myr ago, the Earth's rotation period was 23.565625 hours. Thereby we can find the Kepler's constant with Earth as center 69.5 Myr ago was $C=17.474339\times10^{12}$ (m^3/s^2)).

Similarly, 3000 years ago (from documented eclipse observations during 3000 years), Kepler's constant was also greatly larger than that of today. If we suppose in the past, the Moon was departing from the Earth at 3.78 cm yr^{-1}. Earth-Moon System's Kepler's constant 3000 years ago can be calculated to be $C=10.252877\times10^{12}$ (m^3/s^2).

Table 2				
Kepler's constant with the Earth as central celestial is gradually decreasing				
Time	Moon's revolution period (days)	Average Earth-Moon distance (m)	Kepler's constant with Earth as center	Rotation of Earth (hours)

			$(\frac{R^3}{T^2} = C)$ (m^3/s^2)	
Current	27.321661	384400000	10.250019×10^{12}	23.934
3000 yr ago	27.321642	384399886.6	10.252877×10^{12}	23.934
69.5 Myr ago	21.034201	381772900	16.941505×10^{12}	23.934
69.5 Myr ago	21.034201	381772900	17.474339×10^{12}	23.565625

Research on coral fossils shows that 400 Myr ago, the Earth rotated per cycle at 21.5 hours. By deduction, 69.5 Myr ago, the Earth's rotation period was 23.565625 hours. Thereby we can find the Kepler's constant with Earth as center 69.5 Myr ago, C= 17.474339×10^{12} (m^3/s^2)). So from the two groups of data 69.5 Myr ago, if the study on coral fossils was precise, then at that time, the Kepler's constant with the Earth as central celestial was 17.474339×10^{12} m^3/s^2.

In comparison of the Earth-Moon System and the 44-s water vortex experiment, we can see they are very alike. In a water vortex, the ratio of the cubic of orbit radius to the square of the period of orbit is a constant, namely $\frac{R^3}{T^2}$ =K. With the passage of time, the vortex constant is gradually decreasing. In the universe, the Kepler's constant of Earth-Moon System with the Earth as central celestial is gradually decreasing. The studies on nautiloids and Earth-Moon distance provide us some inspiration and foundation. But to prove the presumption that "Kepler's constant is gradually decreasing", we need more precise and tight evidence.

Then the fourth and fifth achievements both illustrate a problem that with the passage of time, the Earth's rotation is gradually slowing down.

The overall revolving speed in the 44-s water vortex is gradually slowing down. In the Earth-Moon System, the Earth's rotation is also gradually slowing down, so the water vortex once again is surprisingly identical to the earth system.

For humans, 100 or 200 years are such a long period, but for the earth, thousands of years are only an instant. So we cannot treat the Earth with humans' thinking and vision. We cannot judge the Earth-Moon System's Kepler's constant only using tens of years' observations, because these results usually show that Kepler's constant is not changing. But it is not "not changing", but only changing at a very small level. So short period of observations cannot reveal the tiny changes of Earth-Moon System's Kepler's constant. Such tiny changes may easily be considered as experiment error and thus be ignored. But with the increasingly advanced laser ranging technologies and the increasingly precise timing means, we have the chances to observe how Kepler's constant is changing.

Of course in a long enough time span, such as thousands of years, we can obviously see that in the Earth-Moon System with the Earth as central celestial, its Kepler's constant is evidently changing, and actually it is gradually decreasing. However, based on the information we have now, we can hardly know "Earth-Moon distance", and "Moon's revolving period around the Earth" at the same age, which makes it harder for us to better understand Kepler's constant.

4. Characteristics shared by celestial system and vortex system.

Table 3		
Type	Orbit	Constant
Vortex	Vortex orbit is usually elliptic	For a section of a vortex, the ratio of the cubic of orbit radius to the square of the period of orbit is a constant, namely $\frac{R^3}{T^2}$ =C. The value of this constant is related to the size of the vortex. A larger vortex produces a larger C ($\frac{R^3}{T^2}$).
Celestial system	In celestial system, the orbits of fixed stars, planets, satellites and comets are all elliptic. Some comets are in hyperbolic or parabolic orbits, and only get close to the Sun once. Once they depart, they cannot return, which is called non-periodic comets. Such comets may not be a member of the solar system, but are	In solar system, the ratio of the cubic of orbit radius to the square of the period of orbit is a constant, namely $\frac{R^3}{T^2}$ =C. The value of this constant is only related to the mass of the celestial body, so the larger mass the central celestial gets, the larger C is. (note: existing science is wrong to

	travelers from outside of the solar system. They invade the solar system accidentally, and then without hesitation, return to the deep boundless universe. They may also revolve around certain central celestial, but this central celestial is the Sun.	estimate a celestial body's mass, because Newton's formula of universal gravitation was copied from Kepler's Third Law by falsely adding an artificial definition. Cavendish's torsion balance experiment also was unreliable with many flaws and obtained a deceptive gravitational constant G. These will be discussed in detail in another paper).

Table 2		
Type	Variation of constant	Revolution period and linear revolution velocity
Vortex	Analysis on the first section of vortex shows that C=212; analysis on the second section of vortex shows that C=55. The two sections were sampled at an interval of 8.44 s, but their constants differ nearly 4 times. Within a unit time, the first vortex sample has higher energy and higher average revolving speed, so its constant is larger. Within a unit time, the second vortex sample gets lower energy, so its constant is smaller. But from the whole vortex of 44 s, this constant	**Water vortex orbital linear velocity:** the closer to a vortex's center, the larger the velocity of water flow (linear velocity) becomes; the more outside it gets, the smaller the velocity becomes. The orbital linear velocity gradually decreased from center to outside. **Revolution period of water vortex:** the closer to the vortex's center, the shorter revolution period the flow gets; the farther from the vortex's center, the longer revolution period the flow becomes. (also applies to

	is gradually decreasing, and it finally disappears when the vortex returns to quiescence. In general, for the whole water vortex, from when it starts to when it finally returns to quiescence, the vortex constant is gradually decreasing with the passage of time.	atmospheric vortexes, such as typhoon).
Celestial system	In the universe, the Kepler's constant of Earth-Moon System with the Earth as central celestial is gradually decreasing. The studies on nautiloids and Earth-Moon distance provide us some inspiration and foundation. We can find the Kepler's constant with Earth as center celestial body 69.5 Myr ago was 17.474339×10^{12} (m^3/s^2)) . Then we can find today's Kepler's constant with Earth as center was C= 10.250019×10^{12} (m^3/s^2). Kepler's constant in earth-moon system may also be decreasing (the above data require more restrict proof. Only for reference).	**Planets' average linear revolution velocity:** in solar system, the closer to the sun, the larger the linear revolution velocity becomes; the farther away from the sun, the smaller the linear revolution velocity becomes. From the Sun's center to outside, the average linear revolution velocity gradually decreases. **Average linear revolution velocity:** Mercurial> Venus> earth> Mars> Jupiter> Saturn> Uranus> Neptune **Revolution period of planets:** the closer to the sun, the shorter the revolution period gets; the farther from the sun, the longer revolution period becomes **Revolution periodic times:** Mercurial < Venus < earth < Mars < Jupiter < Saturn < Uranus < Neptune

Table 3		
Type	Revolution and rotation	Synchronous rotation
Vortex	In turbulent in nature, a large vortex is always surrounded by many small vortexes, which revolve around the large vortex. Usually and in most cases (few cases in exception), the large vortex and the small vortexes are in the same rotation direction.	In a water vortex system, most rotations are synchronous, such as the walnut in the vortex experiments.
Celestial system	In solar system, the major planets are revolving around the Sun; except Venus and Uranus, other planets rotate in the same direction as the Sun.	In solar system, the natural satellites of most planets are synchronously rotating.

Table 4		
Type	Procession	Matter density distribution in vortex
Vortex	The problem of procession also exists in vortexes.	When colored powder was spilled in a water vortex, we discovered that the largest power density was at to the vortex center; the smallest density was at the vortex edge; This indicates that power (matter) density is gradually decreased from center to edge.

Celestial system	In celestial system, progression exists in all rotating celestial bodies. (All celestial bodies are rotating).	**Distribution of Earth's internal density:** among all celestial bodies, we are most familiar with the Earth. The internal Earth has two discontinuity surfaces, which separate the Earth into three major concentric layers: crust, mantle and core. The closer to core (Earth's center), the larger the matter density gets, so the average density ranges: core > mantle > crust. **Distribution of Earth surface air density:** the closer to ground, the larger air density becomes; as height increases, air density gradually decreases. **Conclusion:** from core to aerosphere, the average matter density gradually decreases. This specially layered density structure is completely consistent with the characteristics of vortexes. (actually Earth's center may be void, or Earth's density may be smaller than that of other parts. This will involve universal gravitation and Cavendish and will be discussed in another paper).

The more we understand vortex system, the closer we find it is to celestial system. Vortexes exist in nature extensively. They may be a precious key for us to understand the nature of the world.

5. Research by other scientists

5.1 http://arxiv.org/pdf/0907.2469v2

5.2 Rotation of Venus is slowing down

In 1990s, NASA's Magellan Probe detected 1 Venus day, which is the time for the planet to complete a rotation, equal to 243.0185 earth days.

However since 2006 when Venus Express started to encircle this cloud-enveloped planet, new measurements indicate that the current rotary period is 6.5 min longer. Researchers reported the results on Icarus in February.