The Origin of Gravity and the Impetus for Celestial Motions

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Abstract: Newtonian mechanics is a subfield of mechanics that deals with the motion of particle, and is by far the most clear and concise kinematics. Although Newtonian mechanics can well describe the motion of particle, it is not applicable to the motion of bodies other than particle. That is why it could not explain the rotation and revolution of celestial bodies as well as the impetus for their movements. Based on Newtonian mechanics, this paper presented an extended discussion of the motion of non-particle objects and put forth a new kinetic theory that can well explain the rotation and revolution of celestial bodies and the motivating force for their movements. Meanwhile, it provided a feasible way of explaining the origin of gravity.

Key word: matter; space; motion; rotation; revolution

Introduction:

In the history of physics, Newtonian mechanics is undoubtedly a great success. Newton believed that space is absolute and flat. Based on this assumption, he developed Classical mechanics. Since Newtonian mechanics is the theory governing the motion of particles, it is not applicable to the motion of objects other than particles. That is why it failed to explain the rotation and revolution of celestial bodies as well as the causes of their movements. The First Cause argument (or cosmological argument) was the biggest regret of Newton's life. In this study, we attempted to build a new set of models of matter, space and gravity, and proposed a kinetic theory on the premise that space has gradients, namely the Kinetic Potential Theory, which can describe the motion of non-particle objects and at the same time account for why celestial bodies spin and orbit and what drives their movements. In light of the models we built, we believed that the smallest units of all matter in the universe are the same and they are called matrix. Space is the matrix state of matter, while matter is the condensed state of space. Gravity is the density gradient of the matrix that forms space, and we can simply call it "spatial gradient". In this way, we provided a feasible way of explaining matter,

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space and gravity. Based on the Kinetic Potential Theory, we defined, for the first time, motion, velocity, and force from the perspective of physics and explained their intrinsic nature. Meanwhile, we unexpectedly explicated the nature of free fall.

1： New Models of Matter, Space and Gravity

The following illustrates how we built the models of matter, space and gravity. Matrix is the smallest unit of all matter, mathematically denoted by a; space (S) is composed of matrix da, i.e. $S=\iiint_{\Omega} dv=\iiint_{\Omega} da$. Space forms matter by means of condensation, which can be expressed as $M=S\cdot k=\iiint_{\Omega} da\cdot k$, wherein k is the coefficient of condensation or coupling. This suggests that space is the matrix state of matter, i.e. $S=\iiint_{\Omega} dv=\iiint_{\Omega} da=\frac{M}{k}$, and that matter is the condensed state of space, i.e. $M=S\cdot k$. Suppose there is a prevalent matrix density in space, namely $\rho=1$, since the formation of matter owes to the contribution of matrix, i.e. $M=\iiint_{\Omega} da\cdot k$, the matrix density in the surrounding space of the matter gets lower, namely $\rho\prec 1$, resulting in a gradient distribution of matrix density, i.e. $\rho\propto\nabla u$. The gradient of matrix density is the same with the gradient of gravitational potential, i.e. $\nabla u=\nabla P$. In other words, gravity is the density gradient of the matrix that forms space, or in short, spatial gradient. It follows that the gravitational field intensity (E) is directly proportional to the divergence of density (ρ) of the matrix (da) that forms space in its initial position $\vec{A}(x,y,z)$, as expressed by the following equation:

$$E\propto div\vec{A}=\frac{\partial P}{\partial x}+\frac{\partial Q}{\partial y}+\frac{\partial R}{\partial z}=\nabla\cdot\vec{A} \quad (1)$$

Since a gravitational field is a convergence field rather than a radiation field, it is a negative source field, i.e. $div\vec{A}<0$. Then, the gradient of gravitational potential equals to the density gradient of the matrix that forms space.

$$\nabla P=\frac{\partial P}{\partial x}\vec{i}+\frac{\partial P}{\partial y}\vec{j}+\frac{\partial P}{\partial z}\vec{k}\Leftrightarrow\nabla u=\frac{\partial u}{\partial x}\vec{i}+\frac{\partial u}{\partial y}\vec{j}+\frac{\partial u}{\partial z}\vec{k} \quad (2)$$

From the above equation, we may know that gravity is the density gradient of matrix. Hence, we proposed a feasible way of explaining the origin of gravity.

Because space is the matrix state of matter and the density of the matrix that forms space presents a gradient distribution, then, we can conclude that the gradient of gravitational

potential is the same with the spatial gradient, as shown below:

$$\nabla P = \frac{\partial P}{\partial x}\vec{i} + \frac{\partial P}{\partial y}\vec{j} + \frac{\partial P}{\partial z}\vec{k} = \nabla V = \frac{\partial V}{\partial x}\vec{i} + \frac{\partial V}{\partial y}\vec{j} + \frac{\partial V}{\partial z}\vec{k} \quad (3)$$

From the above equation, we can see that space is not flat but has gradients.

Then, the gradient intensity of gravitational potential equals to the gradient intensity of space. Considering that the gradient intensity of gravitational potential takes on the negative value of the gradient of gravitational potential, namely $E = -\nabla P$, likewise, the gradient intensity of space is the negative value of the gradient of gravitational potential, which is shown as follows:

$$E = -\nabla V = -\nabla P = -\frac{\partial P}{\partial x}\vec{i} + \frac{\partial P}{\partial y}\vec{j} + \frac{\partial P}{\partial z}\vec{k} \quad (4)$$

As gravitational potential in essence is spatial potential, according to Newtonian mechanics, the relationship between spatial potential and the masses of objects as well as their distance can be expressed as follows:

$$P = G\frac{M}{r} \quad (5)$$

When substituting Equation （5） into Equation （4）, we can derive the relationship between the intensity of spatial gradient field and the mass and distance of objects, as expressed by the following equation:

$$E = -\nabla V = -\nabla P = -\nabla G\frac{M}{r} \quad (6)$$

It can be seen that the intensity of spatial potential field is directly dependent upon the masses of objects and inversely proportional to their distance.

As gravitational potential is spatial potential in nature, for a small object in a spatial potential energy field, its spatial potential is calculated by the following equation:

$$E_P = mgh \quad (7)$$

wherein, h is the radius of the spatial potential energy field.

Again, as gravitational potential energy is a type of spatial potential energy, the relationship between the spatial potential energy of two objects and their distance can be expressed with the equation for gravitational potential energy, as shown below:

$$E = -\frac{GMm}{r} \quad (8)$$

The interactive spatial potential between two objects agrees with Newton's law of universal gravitation, namely:

$$F = G\frac{Mm}{r^2} \quad (9)$$

The above equation implies that gravitational force is spatial potential in nature. So, we can explain universal gravitation in terms of spatial potential (or spatial density gradient).

Specifically, the interactive spatial potential between two objects is directly proportional to the masses of the objects and adversely proportional to the square of their distance.

Brief summary: According to the above statements, we provided a feasible way of explaining matter, space and gravity.

2. Physical Definition of Motion, Speed, Acceleration and Force

2.1 Objects can move, but why? What's the essence of motion? It's unknown to us, and physics never give any scientific explanation or definition. Generally, a movable object is an object whose position changes.

According to Newtonian mechanics, the position vector in flat space is:

$$\vec{r}=x\vec{i}+y\vec{j}+z\vec{k} \qquad (10)$$

Then the position vector in gradient space shall be expressed as follows:

$$\nabla r=\nabla P=\left(\frac{\partial}{\partial x}\vec{i}+\frac{\partial}{\partial y}\vec{j}+\frac{\partial}{\partial z}\vec{k}\right)P \qquad (11)$$

Considering the motion equation in flat space as follows,

$$\vec{r}(t)=x(t)\vec{i}+y(t)\vec{j}+z(t)\vec{k} \qquad (12)$$

The motion equation in gradient space shall be:

$$\nabla r(t)=\nabla P(t)=\frac{\partial P}{\partial x}(t)\vec{i}+\frac{\partial P}{\partial y}(t)\vec{j}+\frac{\partial P}{\partial z}(t)\vec{k} \qquad (13)$$

Equation (12) shows that in Newtonian mechanics, motion is expressed as that space coordinate is the function of time, a pure mathematical formulation without physical meaning. However, according to Equation (13), in gradient space, the motion of an object is expressed as that the space potential of an object is the function of time, i.e., motion in essence is a change of potential energy, which is physically meaningful. So, we gave a physical definition of motion for the first time which also explains the essence of motion.

In traditional theories, the essence of speed is unclear, and the speed of an object is merely mathematically instead of physically meaningful, expressed as follows:

$$\vec{v}=\frac{\Delta\vec{r}}{\Delta t} \qquad (14)$$

According to Equation (13), the motion of object is understood as that the space potential of an object is the function of time. Hence, the speed in gradient space is physically meaningful, which can be expressed as follows:

$$\vec{P}=\vec{v}=\frac{\Delta\vec{r}}{\Delta t} \qquad (15)$$

It can be seen that the magnitude of speed in

Newtonian mechanics is the magnitude of space potential, i.e. $\vec{v}=\vec{P}$. This is the first physical definition of speed which explains the essence of speed.

In traditional theories, the essence of acceleration is also unclear, and the acceleration of an object is not physically meaningful, expressed as follows:

$$\vec{a}=\frac{\Delta\vec{v}}{\Delta t} \qquad (16)$$

In gradient space, as $\vec{v}=\vec{P}$, the acceleration of an object can be expressed as follows:

$$\vec{a}=\frac{\Delta\vec{P}}{\Delta t} \qquad (17)$$

Then it can be derived that in gradient space, the acceleration of an object is expressed as the rate of change of space potential over time, i.e. variability of potential. This is the first physical definition of acceleration of an object which explains the essence of acceleration. It can be seen that only when the space potential of an object changes will this object gain acceleration which further exists in the form of motion.

2.2 According to the first law of Newton, any object has inertia, i.e., the motion of an object does need force to sustain, and the object not under force remains still or in uniform linear motion. But what is inertia in essence? Why does an object need no force to sustain its motion? Why does an object not under force remain still or in uniform linear motion? They have long been puzzles.

As inertia is a kind of motion, motion can be expressed by motion function and accelerated function respectively. Hence, inertial motion can be expressed as follows:

$$\begin{cases}\nabla r(t)=\nabla P(t)=\left(\frac{\partial}{\partial x}(t)\vec{i}+\frac{\partial}{\partial y}(t)\vec{j}+\frac{\partial}{\partial z}(t)\vec{k}\right)P\\ \vec{a}=\frac{\Delta\vec{P}}{\Delta t}\end{cases} \qquad (18)$$

Based on Equation (18), it can be seen that the motion of any object is expressed as the change of its space potential over time. That is, objects not under acting force from other objects will remain motionless or still. So it's safe to say that it is force that changes the original space potential of any object and creates the new space potential, and that the motion of an object needs space potential to sustain (a stone thrown into the air will not keep motional for ever, but falls upon the ground under the gravitation of earth which consumes the space potential of the stone, and keeps stationary relative to the ground).

Hence, it can be concluded that the motion of an object needs space potential to sustain, and when the object is not under force, it will keep

relatively still instead of being in uniform linear motion. The inertial motion of an object is a process of consumption of its own space potential by the gravitation of celestial objects located in its gravitational system. This is our explanation and modification of inertial law.

2.3: At the meantime, the essence of force has never been precisely defined and remained unclear.

According to the second law of Newton $\vec{F} = m\vec{a}$, since acceleration is expressed as the variability of potential $\vec{a} = \frac{\Delta \vec{P}}{\Delta t}$, force can be defined as the product of object mass and variability of potential, i.e., the variability of space potential of the object expressed as follows:

$$\vec{F} = m\vec{a} = m\frac{d\vec{P}}{dt} \qquad (19)$$

It can be derived that the exertion of an acting force on an object will change the space potential of the object. Therefore, force is an interactive potential energy.

When the potential variability of an object remains at a fixed level $\vec{g}$, i.e., $\vec{a} = \frac{\Delta \vec{P}}{\Delta t} = \vec{g}$, which can well explain the motion of a free falling body. Its acting force can be expressed as:

$$\vec{F} = m\vec{a} = m\frac{d\vec{P}}{dt} = m\vec{g} \qquad (20)$$

Based on the above equation, the principle of motion for a free falling body works the same as an ordinary moving object.

Brief summary: By far, we have given precise physical definition of motion, speed, acceleration, inertia and force, which helps to build a new set of physical theories called "Kinetic Potential Theory".

3. The Generalization and Application of Kinetic Potential Theory

3.1: Why will apple fall down upon the earth while stars and the moon will never fall down to the earth?

Generally, every object will create a space potential P in its surroundings. Whether a small object will be drawn close to a large object depends on whether the magnitude of space potential P_M created by the big object in the surroundings of the small one exceeds the magnitude of space potential created by the small object, that is, $P_M \succ P_m$. In consideration of the existence of other objects in the surroundings of the small object, the space potential owned by the small object is actually equal to the space potential P_0 created

by it, which, plus positive and negative space potentials $P_{\pm n}$ ($+n$ represents the increase of P_0 while $-n$ the decrease of P_0) created by other objects, amounts to $P_m = P_0 + P_{\pm n}$.

So, the following conditions are met for the falling of an apple.

$$\begin{cases} P_M \succ P_m \\ P = G\dfrac{M}{r} \\ P_m = P_0 \pm P_n \end{cases} \qquad (21)$$

On the contrary, when the space potential created by a big object in the surroundings of a small object is no stronger than that owned by the small object, i.e. $P_M \le P_m$, the small object will not be pulled to the big one. Therefore the following conditions are met for the no falling of stars and the moon.

$$\begin{cases} P_M \le P_m \\ P = G\dfrac{M}{r} \\ P_m = P_0 \pm P_n \end{cases} \qquad (22)$$

Also, this can also explain the electron orbit pattern of micro nucleus and hence explain why the electron after loss of momentum will not be pulled towards nucleus.

When the space potentials exerted on the moon by other celestial objects are ignored, in consideration of the average distance between the moon and the earth $384401000m$, and the masses of the earth and the moon $5.98\times10^{24}\text{kg}$ and $7.35\times10^{22}\text{kg}$ respectively, the space potential created by the earth in the surroundings of the moon is:

$$P_M = G\frac{M}{r} = G\frac{5.98\times10^{24}\text{kg}}{384401000\text{m}} \qquad (23)$$

With $1m$ of distance unit, the space potential created by the moon in its surroundings is:

$$P_m = G\frac{M}{r} = G\frac{7.35\times10^{22}\text{kg}}{1\text{m}} \qquad (24)$$

Where:

$$P_M = G\frac{5.98\times10^{24}\text{kg}}{384401000\text{m}} \prec P_m = G\frac{7.35\times10^{22}\text{kg}}{1\text{m}} \qquad (25)$$

Clearly, the space potential created by the moon in its surroundings is bigger than that created by the earth in the surroundings of the moon. Therefore, the moon will never fall down to the earth and neither will stars.

3.2 Why do celestial bodies (the earth) orbit?

Only when its own space potential is not weaker than that of fixed star it revolves, the planet will not be pulled towards the star, i.e. $P_m \ge P_M$. In this case, the planet is in the space potential gradient stronger than that created by the fixed star. Since the planet is

usually surrounded by other celestial bodies, the space potentials of these bodies are interactive. Therefore, the planets will not keep their original space potential, and the space orbit potential of every planet will change over time due to the acting force of other celestial bodies. Acceleration is hence created which is expressed as $\vec{a} = \frac{\Delta \vec{P}}{\Delta t}$. The motion equation of gradient space can be expressed as:

$$\nabla r(t) = \nabla P(t) = \left(\frac{\partial}{\partial x}(t)\vec{i} + \frac{\partial}{\partial y}(t)\vec{j} + \frac{\partial}{\partial z}(t)\vec{k} \right) P$$

.

So, the reason why celestial bodies keep orbit motion and the conditions for orbit motion are as follows:

$$\begin{cases} P_M \le P_m \\ \vec{a} = \frac{\Delta \vec{P}}{\Delta t} \\ \nabla r(t) = \nabla P(t) = \left(\frac{\partial}{\partial x}(t)\vec{i} + \frac{\partial}{\partial y}(t)\vec{j} + \frac{\partial}{\partial z}(t)\vec{k} \right) P \end{cases}$$

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It can be seen that the cause of revolution of celestial bodies is not their own momentum, but the change of their space orbit potential by other celestial borides. The change of such space potential exists in the form of motion. Hence we call it a motional celestial body. The revolution of celestial bodies is a kind of space orbit potential change, and the increase or decrease of potential makes celestial bodies deviate from circular orbit, which explains why the orbit of celestial body is always elliptical. This is one of the creative perceptions of this paper.

Discussion: Traditional Newtonian mechanism is plagued by the puzzle of the existence of the First Cause of the God. This paper suggests that the cause for the motion of celestial bodies is not their inherent kinetic energy but the change of their space orbit potential by the acting force of other celestial bodies. That is, celestial bodies do not have and need kinetic energy for revolution. This explains the puzzle of the existence of the First Cause of the God.

3.3 Why do celestial bodies spin?

The principle of the revolution of celestial bodies applies the same to their rotation. While their revolution is caused by the change of their space orbit potential by external acting force, their rotation is also caused by the change of gravity center by external acting force. Due to their irregular shape and uneven density distribution, the gravity center $G(x, y, z)$ of celestial bodies is not the same as their physical center. When exerted by

the acting force of other celestial bodies, its gravity center will change over time. When the gravity center is displaced, then $\nabla r(t) = \nabla P(t) = \frac{\partial P}{\partial x}(t)\vec{i} + \frac{\partial P}{\partial y}(t)\vec{j} + \frac{\partial P}{\partial z}(t)\vec{k}$.

Its variability of potential is $\vec{a} = \frac{\Delta \vec{P}}{\Delta t}$. As the change of gravity center exists in the form of spinning motion, the condition for the rotation of celestial bodies should be:

$$\begin{cases} G(x, y, z) \\ \nabla r(t) = \nabla P(t) = \frac{\partial P}{\partial x}(t)\vec{i} + \frac{\partial P}{\partial y}(t)\vec{j} + \frac{\partial P}{\partial z}(t)\vec{k} \\ \vec{a} = \frac{\Delta \vec{P}}{\Delta t} \end{cases}$$

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It can be seen that the force to drive the rotation of celestial bodies is not its original momentum, but the change of its gravity center and the consequent displacement of its gravity center, which turns out to be the form of rotation and gains acceleration, when its gravity center is under the acting force of other celestial bodies. So, it's no violation of energy conservation. This is the resolution of our long puzzle over the reason of the rotation of the earth.

Discussion: As the rotation of celestial bodies is caused by the change of its gravity center potential, it's safe to predicate that the smaller the stability of its gravity center (it's uneven in density distribution, irregular in shape, and liquid on surface or in interior), the bigger its rotation speed. For instance, magma is present in the interior of the earth and liquid water on its surface, while neither is present in the moon. So, the stability of the earth's gravity center is smaller than that of the moon. That's why the earth rotates faster than the moon.

3.4 Why do objects take free-fall motion, and why do objects of different masses fall down upon the ground at the same time?

It's well-known that objects will free fall, but why? And why do objects of different masses fall down upon the ground at the same time? This remains an unsolved mystery in physics. Common sense tells us that heavy objects fall faster than light objects. But according to the second law of Newton, the earth exerts the same force on heavy and light objects. Thus, the greater the mass of an object, the smaller its acceleration. Hence, light objects shall touch upon the earth faster than heavy ones. The truth, however, is that both of them touch upon the earth simultaneously.

Surely, it doesn't mean that the earth is self-conscious, or that an additional force is exerted on heavy object to ensure the simultaneous touching upon the earth of both

heavy and light objects. The essential cause for free-fall motion is the change of space potential, a kind of one-dimensional vector motion in gradient space, which meets the condition $\Delta\vec{r} = \overrightarrow{r_B} - \overrightarrow{r_A} = \left(\frac{\partial P}{\partial z_B} - \frac{\partial P}{\partial z_A} \right) \vec{i}$.

And as for the reason why both heavy and light objects touch upon the earth at the same time, it shall be noted that the exertion target of space potential is component, or precisely the same minimum unit of every matter: matrix. In other words, the free falling of an object cannot be deemed a whole but countless matrixes which fall simultaneously (for instance, a bowl of peas fall down just as these individual peas fall down, each instead of the whole exerted by the force of the earth). This explains why objects of large and small masses simultaneously touch upon the earth. $\nabla r(t) = \nabla P(t) = \frac{\partial P}{\partial z}(t)\vec{i}$ represents the change of an object's space potential over time, where its variability of potential is $\vec{a} = \frac{\Delta \overrightarrow{P}}{\Delta t} = \overrightarrow{g}$. Therefore, the motion of a free falling object in essence can be expressed as follows:

$$\begin{cases} G(x, y, z) \\ \nabla r(t) = \nabla P(t) = \dfrac{\partial P}{\partial z}(t)\vec{i} \\ \vec{a} = \dfrac{\Delta \overrightarrow{P}}{\Delta t} = \overrightarrow{g} \end{cases} \qquad (28)$$

It can be seen that the target exerted by the force of gravitation is component. Truly, the above elaboration is an indication of the existence of a new matter called "matrix".

Brief summary: We have successfully explained the causes and the impetus origin of the revolution and rotation of celestial bodies as well as the reason why both heavy and light objects fall down upon the earth at the same time.

4. Conclusion

As a milestone of physics development, Newton discovered the existence of universal gravitation and founded Newtonian mechanics based on absolute space, which has changed our perception of the universe. But the weaknesses of Newtonian mechanics is its failure to account for the origin of gravity and the motion of non-particle objects, which results in its disability to well explain the phenomena and the impetus origin of the revolution and rotation of celestial bodies. Thence comes the First Cause of the God. The relativity theory by Einstein claiming the

relativity of space and the distortion of space by matters as the origin of gravity is the first feasible hypothesis to explain the origin of gravity, which modifies the absolute space argument by Newton. However, both Newton and Einstein regard matter, space and gravity as independent objects, and both fail to explain the phenomena and the impetus origin of the revolution and rotation of celestial bodies. This paper offers an alternative argument for the origin of gravity, which correlates matter, space and gravity, and applies Newtonian mechanics to non-particle motion. This theory well explains the phenomena and the impetus origin of the revolution and rotation of celestial bodies. But it shall be noted that since this paper focuses on fundamental issues of physics and is based on our creative perceptions, no reference is available to be cited here except one textbook.

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Reference:

【1】 San-Hui Zhang, College Physics (third edition) (Tsinghua university press, Beijing 9,2008) chap.1-2.