

Quantum Property of Gravitation and Research on Nature of Dark Matter

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Abstract: On the basis of Planck quantum hypothesis and Einstein photon quantum hypothesis, Zhongjizi (a new elementary particle) hypothesis was proposed to reveal the essence of photon, the origin of mass, the quantum property of gravitation, and the nature of dark matter. The results show that photon is essentially a set of Zhongjizi, light is composed up of Zhongjizi, the nature of light is particle property, the property of light is determined by the property of Zhongjizi, and the quantum property of light is essentially Zhongjizi property of light. Zhongjizi is the most basic particle in the universe and the origin of mass, which gives mass to other particles. Zhongjizi is particle transmitting the gravitation; gravitation transmission speed is equal to the speed of light. The quantum property of gravitation is the property that gravitation is transmitted by Zhongjizi. The so-called dark matter is essentially Zhongjizi full of the universe and transmitting gravitation, so Zhongjizi is the so-called dark matter particle.

Key words: Nature of dark matter, origin of mass, quantum property of gravitation, essence of photon, Zhongjizi hypothesis.

1. Introduction

We know that our understanding of the world has started from light ever since the birth of mankind on the earth, but what is light in the end? This question has always been a mystery for us. At present, our understanding of the essence of light and photon is still in exploration.

In over a century, human exploration to the ultimate component of matter was carried out on four levels of matter's structure. Any matter is made up of atoms, atom is made of nuclei and electrons, nuclei are made up of protons and neutrons; and proton and neutron are thought to consist of quarks. Up to now, people have not yet found free quarks, and no evidence shows that quarks and leptons have any internal structure.

At present, four kinds of basic interactions have been found, namely, gravitational interaction, electromagnetic interaction, weak interaction and strong interaction. It has been found that photons are particles that transmit electromagnetic interactions,

and the intermediate bosons W^+ , W^- , and Z^0 are particles that transmit weak interactions. So far, theoretically predicted gravitons that transmit gravitational interactions and gluons that transmit strong interactions have not been found in experiments. As of now, we have not yet fully understood the nature of gravitation, and have not established a unified theory for understanding the four kinds of basic interactions.

Although the existence of dark matter has widely accepted since the early 1970s, we still know nothing about the nature of dark matter, what is dark matter on earth? Theoretical and experimental researchers are currently exploring.

Based on Planck's quantum hypothesis, Einstein's photon quantum hypothesis and scientific facts, Zhongjizi (a new elementary particle) hypothesis was proposed to reveal the essence of photon, the origin of mass, the quantum property of gravitation and the nature of dark matter.

2. Zhongjizi Hypothesis

In 1900, Planck, facing insurmountable difficulties

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in classical physics, boldly put forward the energy quantization hypothesis. His basic idea is to consider matter as a system composed of many linear harmonic oscillators. The energy radiated and absorbed by the linear harmonic oscillators is not random and continuous, but an integral multiple of certain minimum energy element $h\nu$, where ν is the vibration frequency of the harmonic oscillator, h the planck constant, usually known as the acting factor or the acting quantum [1].

In the Planck's quantum hypothesis, $h\nu$ is a minimum energy element, and the energy radiated and absorbed by any matter is an integral multiple of $h\nu$. The vibration frequencies (ν) of the harmonic oscillators of different matters are different, which determines that $h\nu$ is a minimum energy element that varies with the change of ν . The minimum energy element $h\nu$ is only right for the energy radiated and absorbed by the harmonic oscillator with the same vibration frequency. Thus, $h\nu$ is not a minimum energy element with a fixed value.

In the minimum energy element $h\nu$ of Planck's quantum hypothesis, ν is the vibration times of the harmonic oscillator per unit time and h is a constant. It may be assumed that the harmonic oscillator constituting the matter radiates and absorbs a minimum energy element h with a fixed value for each vibration. The energy radiated and absorbed by the harmonic oscillator can only be an integer multiple of the minimum energy element h and proportional to the vibration frequency ν of the harmonic oscillator, and the proportional coefficient is minimum energy element h . In this hypothesis, the physical meaning of the minimum energy element h is the energy with a fixed value radiated and absorbed by the harmonic oscillator when it completes each vibration in period T (vibration period T of the harmonic oscillator constituting matter is much less than 1 s), and the minimum energy element h is a time-related quantity. According to the physical meaning of the minimum energy element h , the energy radiated and absorbed by

the harmonic oscillator with frequency of ν per unit time is h/T . $1/T$ is the number of the harmonic oscillator's vibration times per unit time, that is the vibration frequency ν of the harmonic oscillator, thus, $h/T = h\nu$, which is the minimum energy element $h\nu$ in the Planck's quantum hypothesis. It can be seen that the minimum energy element h in this hypothesis is the acting quantum h in the Planck's quantum hypothesis, and its energy is equal to the Planck constant of $6.62606876 \times 10^{-34}$ J in value [2], which is $1/\nu$ of the minimum energy element $h\nu$ in the Planck's quantum hypothesis, and its energy is a constant in the process of radiation and absorption of matter. This means that the minimum energy element h is a stable matter ive reality. Energy cannot be separated from matter, the matter with very small energy corresponding to the minimum energy element h can be named as Zhongjizi, which is represented by z , and the hypothesis proposed above is called Zhongjizi hypothesis. According to Einstein's mass-energy formula $E = mc^2$ [3], we can calculate the mass of Zhongjizi, that is, $m_z = h/c^2$ (h the energy of Zhongjizi, c the speed of light) $= 6.62606876 \times 10^{-34} / (2.99792458 \times 10^8)^2$ [2] $= 7.37249577 \times 10^{-51}$ kg.

3. Essence of Photon

In 1905, Einstein further assumed that the electromagnetic energy itself is also quantized, that is, the radiated energy itself is also quantized. He believed that radiated energy is composed of discrete energy. A beam of light contains many photons, which are much like the bullets fired from a machine gun. Each photon has energy proportional to the radiation frequency. Planck originally called the discrete energy elemental quantum, now it is more precise to call it a photon. The energy ε of the photon is $\varepsilon = h\nu$ [1]. The photon theory proposed by Einstein is a generalization of Planck's quantum concept. The photon in Einstein's photon theory is the minimum energy element $h\nu$ in the energy quantization

hypothesis proposed by Planck. According to Zhongjizi hypothesis, energy $h\nu$ of each photon of the light with frequency ν should be the energy of ν Zhongjizi. It can be seen that the photon proposed by Einstein is not an independent matter, but a set of ν (the frequency of light) Zhongjizi. The mass of Zhongjizi is very close to the upper limit of measured photon quiescent mass 10^{-50} kg [4]. The upper limit of the quiescent mass of photons measured here is actually the upper limit of the mass of Zhongjizi, since the mass measured experimentally is the mass of particles making up the light. According to the observed energy $\Delta E = 22.20$ MeV released in the nuclear reaction $\text{Li}^6 + \text{H}^2 \rightarrow \text{H}_e^4 + \text{H}_e^4$ and mass change $\Delta m = 0.02381(u)$ [5], with the energy h ($6.62606876 \times 10^{-34}$ J) of Zhongjizi, we can calculate the mass of a Zhongjizi $m_z = \Delta m / \Delta E / h$ (ΔE the radiated energy released by this nuclear reaction, which should be the energy of n Zhongjizi in accordance with Zhongjizi hypothesis, $n = \Delta E / h$ the number of Zhongjizi radiated from the nuclear reaction) $= 0.02381 \times 1.66 \times 10^{-27} / 22.2 \times 10^6 \times 1.602 \times 10^{-19} / 6.6261 \times 10^{-34} = 7.36 \times 10^{-51}$ kg. This is very close to the mass $m_z = 7.37249577 \times 10^{-51}$ kg of Zhongjizi obtained through theoretical calculation. Positrons will encounter ordinary electrons in flying process, and then they will be annihilated into two photons. The energy E_r of each photon should be $m_0 c^2 = 0.511$ MeV, in which m_0 is the rest mass of an electron, which has been experimentally verified [6]. The photon is a set of Zhongjizi, so positron and negative electrons are annihilated into Zhongjizi. According to the law of mass conservation, the mass m_0 of an electron will be converted into the mass of Zhongjizi, with energy h $= 6.626068786 \times 10^{-34}$ J of a Zhongjizi, we can calculate the mass of a Zhongjizi to be $m_z = m_0 / E_r / h = 7.373 \times 10^{-51}$ kg. This is also very close to the theoretical value $7.37249577 \times 10^{-51}$ kg of the mass of a Zhongjizi. The process of positron and negative electron annihilation into Zhongjizi fully demonstrates that mass and energy can neither be created nor

disappear, they are the intrinsic basic properties of matter and can only be transformed from one form to another. It also explains the nature of the mass-energy relationship $E = mc^2$, that is, $E = mc^2$ represents the energy radiated by matter with mass m equals the sum of the energy of Zhongjizi transformed by the matter. Since the mass of a Zhongjizi is m_z , and the speed of Zhongjizi is the speed of light c , as known by the definition of energy (vitality), $E = mv^2$ [7], so the energy of a Zhongjizi is $E_z = m_z c^2$. When the matter (such as a pair of positive and negative electrons) of mass m is totally converted into radiated energy, that is, Zhongjizi, the energy released is: $E = m / m_z \cdot m_z c^2 = n \cdot m_z c^2 = mc^2$ ($n = m / m_z$ the number of Zhongjizi converted by matter of mass m). It can be seen that Einstein's mass-energy relation $E = mc^2$ can be derived from the mass and speed of Zhongjizi, the definition of energy, and mass conservation law. Now, experimental verification of $E = mc^2$ has been close to be perfect: the difference between E and mc^2 is less than five ten-millionths (5×10^{-7}) [8]. This fully shows that Zhongjizi has mass and is the real existence of an independent matter. Therefore, the light consists of Zhongjizi with the same mass and energy, the only difference is the frequency of light. The frequency of light is equal to the vibration frequency of the harmonic oscillator, also is equal to the frequency of the harmonic oscillator radiating Zhongjizi, that is, the number of Zhongjizi radiated by the harmonic oscillator per unit time, the frequency of Zhongjizi, that is, the number of Zhongjizi with the same phase in the same harmonic oscillator radiation passing through certain point in space. The wavelength of light is the distance between two adjacent Zhongjizi in a series of Zhongjizi with the same frequency and phase of the same harmonic oscillator's radiation. The period of light equals to the time for one vibration of the harmonic oscillator and the time Zhongjizi takes to propagate by a wavelength in space. The propagation of light is the periodic motion of Zhongjizi streams (the light is composed of

these Zhongjizi streams) emitted by harmonic oscillator's vibration. The propagation of light in space is shown in Fig. 1, which shows the propagation in space of light with the same frequency emitted by light source S. According to the wave theory, the light is a "wave spreading around, while moving forward", as shown in Fig. 2. According to the particle theory, the photons making up the light keep moving in clusters (particles), and then the energy should remain the same no matter how far the photon move, as shown in Fig. 3. Fig. 2 shows the wave aspect of the

light, but not the particle aspect of light. Fig. 3 shows the particle aspect of the light, but not the wave aspect of light. In Fig. 1, each Zhongjizi represents the particle property of the light, and the periodicity (i.e., the distance between two adjacent Zhongjizi in a series of Zhongjizi is a constant, which is equal to the wavelength of light) of the motions in space of a series of Zhongjizi emitted by each harmonic oscillator shows the wave property of light. Thus, Fig. 1 shows the so-called wave-particle duality of light. It can be seen that the wave aspect of light is

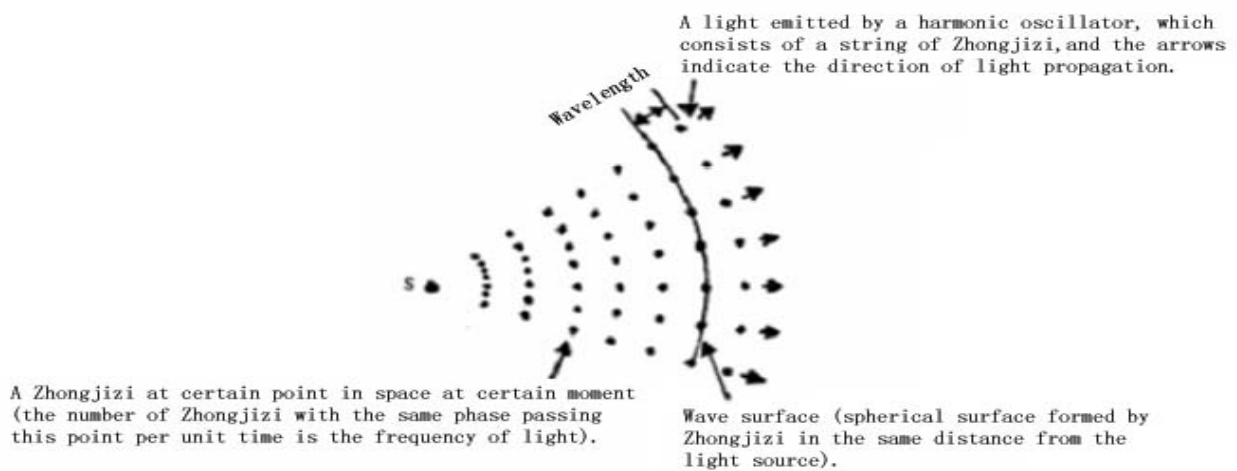


Fig. 1 Propagation of light in space.

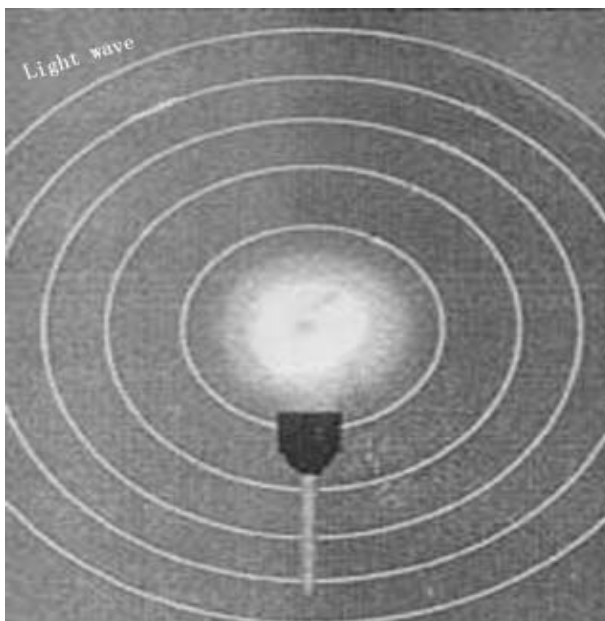


Fig. 2 Even propagation of light wave to the surrounding in space [9].

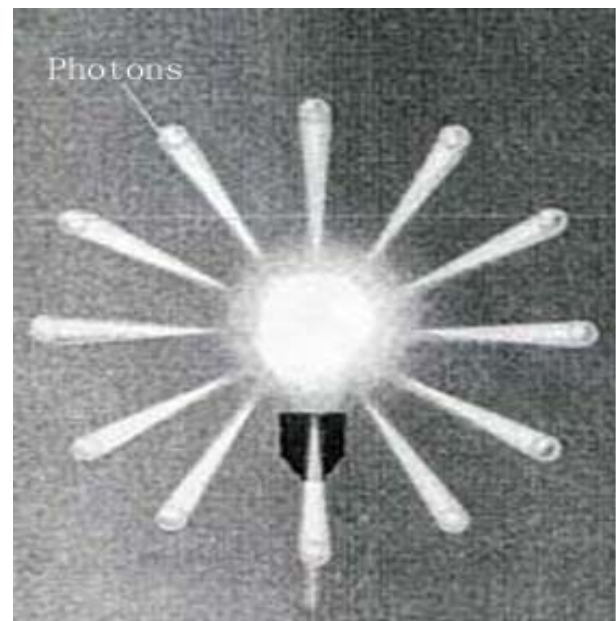


Fig. 3 Spreading of photons to the surrounding in space [9].

actually determined by the periodicity of the motion of Zhongjizi stream emitted by the harmonic oscillator. At this point, we can say that the nature of light is particle, and the photon is essentially a set of Zhongjizi. Light is composed of Zhongjizi, and the property of light is determined by that of Zhongjizi. The so-called wave-particle duality of light can be united by Zhongjizi property of light. The quantum property of light is essentially Zhongjizi property of light, and the quantum of light is Zhongjizi.

4. The Origin of Mass

We know that electron pairs can be generated by hitting the lead nuclei with photons of larger than 1 MeV. In addition, the statement that electron pair annihilates into photon pairs has also been verified by experiments [10]. Because photon is a set of Zhongjizi, so the first process is actually that Zhongjizi is converted into electron pairs, and the second process is that electron pairs annihilate into Zhongjizi. It can be inferred that the positron and the negative electrons are composed of Zhongjizi, which are the basic constituting element of matter in deeper level. In the collision experiment of high-energy electron and positron, one produces a pair of $u(u^-, u^+)$, and the other produces a pair of quark and anti-quark $q(q, q^-)$. We have known that the collision is realized in two steps: $e^- + e^+ \rightarrow$ virtual photon (1) virtual photon $\rightarrow u^- + u^+$, (2) $q + q^- \rightarrow$ hadron. In the first step, the electron and positron annihilate into one “virtual photon” (r), which in the second step converts into $u^- + u^+$ or $q + q^-$, the quark and anti-quark in turn converts into various hadrons (π meson, K meson, nucleon and anti-nucleon) [11]. Because the photon is a set of Zhongjizi, in this experiment process, actually electrons and positrons annihilate into Zhongjizi in the first step, and Zhongjizi converts into $u^- + u^+$ or $q + q^-$ in the second step, and the quark and anti-quark in turn converts into various hadrons. Accordingly, the pair of quark and anti-quark, and various hadrons are made up of Zhongjizi. Because quarks and nucleons are

components of the nucleus, so the nucleus is also composed of Zhongjizi. This experimental fact further shows that Zhongjizi is a basic element of matter in a deeper level. As of now, it has not been found that photon converts to other smaller particles. It can be said that Zhongjizi is the most basic component of matter and the most basic particle in the universe, and the mass and energy of Zhongjizi are the smallest element. Therefore, the nature of the concept of mass should be understood that mass is a measure of the amount of matter (the number of Zhongjizi) contained in the matter. The more the amount of matter (the number of Zhongjizi) contained in the matter, the larger the mass of the matter, on the contrary, the mass is smaller. Mass is a basic property and a reflection of the existence of matter. As long as a matter exists, it has certain mass, that is, it contains a certain amount of matter (a certain number of Zhongjizi). This means that the mass of a matter has quantum property, and the smallest quantum mass is the mass of a Zhongjizi, which is a constant h/c^2 (h the energy of a Zhongjizi, c the speed of light) of $7.37249577 \times 10^{-51}$ kg. Zhongjizi should be the benchmark of the quantum mass, and the mass of any matter should be an integer multiple of the mass of a Zhongjizi. If a matter contains $1.35639278 \times 10^{50}$ Zhongjizi, then its mass will be 1 kg. Because light is a set of Zhongjizi and Zhongjizi has mass, so photon also has mass. At present, people believe that the mass of photon is zero, which is caused by the current definition of mass (mass is “the difficulty in accelerating matter” [12]). If the total mass of all matters in the universe is M , then $M = Nm_z$, N is the total number of Zhongjizi that make up all matters in the universe, and m_z is the mass of a Zhongjizi. It can be seen that Zhongjizi is the origin of mass, which gives mass to other particles. The reason why each particle in the universe has its mass is that it contains a certain number of Zhongjizi.

5. Quantum Property of Gravitation

As we know, the matter under any temperature not

only radiates to the surrounding, but also absorbs such radiation from the surrounding [1]. Celestial bodies, such as the Earth, constantly receive short-wave radiation from the sun and stars, and also continuously emit thermal radiation to the space. Since the birth of the Earth, such energy exchange has never stopped [13]. Thus it can be seen that energy exchange through the radiation and the absorption of radiation between matters on the Earth or between the celestial bodies has never stopped since their births. According to Zhongjizi property of light, energy exchange between matters through radiation and absorption of radiation is achieved by exchanging the minimum energy element h , that is, by exchanging Zhongjizi. It is conceivable that the universe is filled with Zhongjizi, and the space filled with Zhongjizi can be called Zhongchang. Matters interact with each other by exchanging Zhongjizi (i.e., energy) through the Zhongchang. It may be assumed that interactions between matters not in contact with each other in the universe are generated by energy (i.e., Zhongjizi) exchange in the Zhongchang. The acting force is proportional to the energy exchanged between the two matters per unit time. Let F be the acting force between two matters and E the energy exchanged between two matters per unit time, then $F \propto E$. When the energy is exchanged between two matters, the more the energy radiated by the matter per unit time, the more energy will be exchanged between the two matters. Let n_1 and n_2 be the number of Zhongjizi radiated by the two matters per unit time, h the energy of Zhongjizi, then $E \propto n_1 h$, $E \propto n_2 h$, because $F \propto E$, so $F \propto n_1 h$, $F \propto n_2 h$. Matter radiates as a spherical surface, the density of Zhongjizi on the spherical surface in the distance of r from the matter, as r increases, the spherical surface area ($S = 4\pi r^2$) increases by r^2 , and the density of Zhongjizi increases by $1/r^2$. When Zhongjizi are exchanged between matters, the larger the density ρ of Zhongjizi, the more Zhongjizi are exchanged per unit time, and the more energy is exchanged per unit time. So, $E \propto \rho$. Because $\rho \propto 1/r^2$,

$F \propto E$, so $F \propto 1/r^2$. Put $F \propto n_1 h$, $F \propto n_2 h$ and $F \propto 1/r^2$ together, then $F \propto n_1 n_2 h^2 / r^2$ or

$$F = C n_1 n_2 h^2 / r^2 \quad (1)$$

where, C is the proportional coefficient, and r the distance between centers of the two matters. Formula (1) shows that the interaction between two non-contacting matters in the universe is generated by the exchange of energy through Zhongchang (realized by the exchange of Zhongjizi). The acting force is proportional to the energy radiated by the two matters, while it is inversely proportional to the square of the distance between the two matters. This kind of acting force between matters can be called the exchanging force, and the interaction between law matters is called the law of exchanging force. The law of exchanging force is the law explaining the interaction between matters from the microscopic point. In accordance with the law of exchanging force, the exchanging force is generated exchanging Zhongjizi between matters through Zhongchang. The exchanging of Zhongjizi is discontinuous and has quantum property. Therefore, the exchanging force has quantum property.

According to the law of exchanging force, for two uncharged matters, set their mass is m_1 and m_2 respectively, the energy radiated by them per unit time are $n_1 h$ and $n_2 h$ (n_1 and n_2 are the number of Zhongjizi radiated by the two matters per unit time, and h the energy of a Zhongjizi), the distance between the two matters is r , then the acting force between the two matters is $F = C n_1 n_2 h^2 / r^2$ (2). Because the energy exchange through radiation and absorption of radiation between matters is completed by electrons and nuclei constituting the matters, the more electrons and nuclei contained by the matters, the more energy will be radiated by the matters per unit time. That is to say the energy radiated by the matter is proportional to the number N of electrons and nuclei in the matter, and the mass m of the uncharged matter is proportional to the number N of electrons and nuclei. Therefore, we can obtain $n_1 h \propto m_1$, $n_2 h \propto m_2$, that is,

$n_1 n_2 h^2 = C_1 m_1 m_2$, C_1 is the proportionality coefficient, substitute it in Eq. (2), we can obtain $F = CC_1 m_1 m_2 / r^2$, set $CC_1 = G$, then $F = G m_1 m_2 / r^2$. Compare it with the law of gravitation $F = G m_1 m_2 / R^2$ [14], we can know that the mathematical expressions of the two are the same. It can be seen that the law of gravitation is only a macroscopic representation of the law of exchanging force, and it is the law to represent the interaction between matters in the macroscopic point of view. The gravitation interaction is essentially generated by exchange of energy through Zhongchang (i.e., Zhongjizi) between matters. The acting force is proportional to the energy radiated between the two matters per unit time, and inversely proportional to the square of the distance between the two matters. Zhongjizi is particle transmitting the gravitation, so the gravitation interaction is quantum property and discontinuous. The speed of Zhongjizi is equal to the speed of light, so gravitation transmission speed is equal to the speed of light. Therefore, the quantum property of gravitation is essentially the property that the gravitation is transmitted by Zhongjizi. A French research team, by tracking hundreds of neutrons falling from the top of the instrument down to the bottom, found that particles exist only at specific heights and their motions are not continuous, but they jump from one height to another as predicted by quantum mechanics [15]. The fact of this experiment is one example that the gravitation interaction has quantum property. Since the gravitation effect of neutrons is quantum property and discontinuous, it is determined that the motion of neutrons is not continuous, but rather jumping from one height to another.

It can predict according to the quantum property of gravitation that: If the energy (i.e., the number of Zhongjizi) exchanged between two matters that not contacting with each other changes, then the acting force between the two matters will also change. During total solar eclipse in Mohe on March 9, 1997, Tang Keyun researcher from the Institute of Geology

and Geophysics, Chinese Academy of Sciences, led the expedition to conduct a comprehensive observation of the physical geography at the Geomagnetic Observatory of the Institute of Geology and Geophysics in Mohe township, Mohe County, Heilongjiang, gravity anomalies during total solar eclipse in Mohe were observed [16]. This fact is an example of this prophecy. The existence of the moon changes the energy exchange between the sun and the Earth, so the gravity of the Earth will also change. It can also be predicted that: the earth's gravity in the day and night becomes abnormal, which can be measured using gravimeter.

6. Nature of Dark Matter

The most direct evidence for the existence of dark matter is the rotation curves of the galaxy and some nearby galaxies obtained after 1970. According to the mechanics principle, its rotational motion centripetal force equals to gravitation. At position far away from the center of the galaxy, the attraction of the galaxy should gradually weaken, so the rotation speed should be reduced. However, many of the observed galactic rotation curves are still flat at the edge of observable galactic disks, demonstrating that there is still a large amount of unobserved matter, i.e., dark matter, outside the galactic disk. In addition, for many observed galaxy disks, it must be assumed that there is dark matter with large mass distributed around the disk in order to explain the dynamics stability of these galaxies. Now, the existence of dark matter has been accepted by most astronomers [17]. Thus, the conclusion of the existence of dark matter is obtained under the premise of considering only a narrow range of gravitation, that is, around the center of the galaxy and the galaxy disk, without considering that gravitation between matters is all around the whole universe. According to the quantum property of gravitation, the gravitational interaction between matters in the universe is generated by the energy (i.e., Zhongjizi) exchange between matters through

Zhongchang. Gravitation comes from Zhongjizi exchanged between matters through radiation and absorption of radiation. Zhongjizi filling the universe transmits gravitation, and any matter in the universe is subjected to the gravitation transmitted by Zhongjizi radiated from all the matters in the universe. The so-called gravitational field is essentially Zhongchang filled with Zhongjizi, and the matter anywhere in the universe will be subject to the gravitational force transmitted by Zhongjizi in the gravitational field. The dynamics stability of the galaxy is due to the gravitational effect transmitted by Zhongjizi filling the universe. Therefore, the so-called dark matter is essentially Zhongjizi filling the universe and transmitting gravitational force, and Zhongjizi is the so-called dark matter particles. Because Zhongjizi is also the constituent particles of light, but Zhongjizi themselves do not emit light or absorb light, so Zhongjizi (the so-called dark matter) filling the universe and transmitting gravitation are not detected. Although we can detect light filling the universe, but we do not know the constituent particles of light—Zhongjizi are the particles transmitting gravitation and generating gravitational effect, that is, Zhongjizi is the so-called particle of dark matter. It can be called that we look at the dark matter particles but cannot see them. The mass m_z of Zhongjizi is $7.37249577 \times 10^{-51}$ kg, and the number density of photons in the universe today is 400 per cubic centimeter [18]. Because photon is a set of ν (ν is the frequency of light) Zhongjizi, a photon with frequency of ν contains ν Zhongjizi. In order to obtain the mass density of Zhongjizi in the universe, the average frequency (5.7×10^{14} Hz) of the visible light [19] with wavelength range of (400~760 nm) can be taken as the frequency of photon in the universe. Thus the mass density of Zhongjizi filling the universe can be calculated as $400 \times 10^6 \times 5.7 \times 10^{14} \times 7.4 \times 10^{-51} = 1.7 \times 10^{-27}$ kg/m³. The total matter density in the universe is about 2.5×10^{-27} kg/m³ [20], so we can see that Zhongjizi filling the universe accounts for about 68%

of the total matter amount in the universe. In recent years, detection of microwave background radiation gives out the composition of cosmic matter: ordinary matter accounts for about 4%, dark matter accounts for about 23%, and dark energy accounts for about 73% [21]. Dark matter and dark energy account for the vast majority of cosmic matter, indicating that there is a certain relationship between Zhongjizi and dark energy in the universe.

7. Conclusions

Based on the Planck quantum hypothesis and the Einstein quantum hypothesis, this paper proposes Zhongjizi hypothesis, which reveals the nature of photon, the origin of mass, the quantum property of gravitation and the nature of dark matter. The results show that photon is essentially a set of Zhongjizi, light is composed up of Zhongjizi, the nature of light is particle, the property of light is determined by the property of Zhongjizi, and the quantum property of light is essentially Zhongjizi property of light. Zhongjizi is the most basic particle in the universe and the origin of mass, and it gives mass to other particles. The reason why each particle in the universe has its mass is that it contains a certain number of Zhongjizi. The gravitational interaction between matters is generated by the energy exchange between matters through Zhongchang (composed by Zhongjizi) (through exchange of Zhongjizi). The acting force is proportional to the energy radiated by the two matters per unit time, and inversely proportional to the square of the distance between the two matters. Zhongjizi are the particles transmitting the gravitation at speed equal to the speed of light. Gravitational interaction is quantum property and discontinuous, and the quantum property of gravitation is essentially the property that the gravitation is transmitted by Zhongjizi. We know that photon is the particle transmitting electromagnetic interaction, because photon is a set of Zhongjizi, so the electromagnetic interaction is also transmitted by Zhongjizi, so that the electromagnetic force and

gravitational are united, both are transmitted by Zhongjizi; The so-called dark matter is essentially Zhongjizi filling the universe and transmitting the gravitation, and Zhongjizi is the so-called dark matter particle. The so-called dark energy also has a certain relationship with Zhongjizi filling the universe. From a historical point of view, a small step forward of the human understanding of “light” or “photon” will result in a big step forward of science. The establishment of quantum mechanics, theory of relativity, quantum electrodynamics and other important scientific theories involves new understanding of “light” [22]. Today, we have brought some new and groundbreaking results by revealing the nature of photon. It is worth to seriously think whether this is a coincidence, or a historical necessity.

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