New Theory of Classical Field Matter

Hongyuan Ye
Yangtze Delta Region Lab of Innovation (Jiashan), China

[Abstract] A mechanical wave is a medium-conducted wave. **A mechanical wave is the phenomenon of the collective movement of many particles participating in vibration at the same time.** There are four kinds of classical field matter: electric fields, magnetic fields, light fields, and gravitational fields, which are independent field matter. This paper proposes that a light wave is the emission wave of light particles, and its essence is particles. A photon is a field energy particle with a phase property. This paper theoretically denies the superposition principle of single photon double-slit interference. A single photon cannot pass through the two slits at the same time, and a single photon can pass through one of the two slits in turn to achieve double-slit interference. **A light wave is the cumulative phenomenon of the individual movement of a single photon particle with the phase property at different times.** Furthermore, a verification experiment to check the superposition principle of single photon double-slit interference is presented. A light shield is used to block one of two slits in turn to ensure that each single photon can only pass through one of the two slits separately. Electric field waves, magnetic field waves, and gravitational field waves have the characteristics of mechanical waves, and because they must not be the emission waves of particles, it is more reasonable that they are medium-conducted waves. The mediums of electric field waves, magnetic field waves, and gravitational field waves are electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta, respectively. This paper further proposes that the eccentric spin and eccentric plane vibration of a photon and the energy fluctuation of a vacuum field are the possible causes for the phase property of a photon.

[Keywords] mechanical wave, field matter, photon, phase property, single-photon double-slit interference, superposition principle, electric field medium quanta, magnetic field medium quanta, gravitational field medium quanta.

1. Introduction

In philosophy, matter is defined as an objective existence. Thus, physical matter can be defined as an objective existence with energy. Physical matter can be further divided into solid matter and field matter. Solid matter includes various forms of macro-objects and all micro-particles and elementary particles. The velocity of solid matter is less than C. There are only four kinds of field matter: electric fields, magnetic fields, light fields, and gravitational fields. The velocity of field matter in a vacuum is a constant, C.

Maxwell’s equations provide an important theoretical basis for modern physics. However, recent studies[1] have demonstrated that two of the four Maxwell’s equations are incorrect. A changing electric field in a vacuum cannot excite a magnetic field, and a changing magnetic field cannot excite an electric field. “Electromagnetic waves” do not exist in the physical world. Light is not an “electromagnetic wave,” and light is a light field itself. Electric fields, magnetic fields, and light fields are the position characteristics, velocity characteristics, and acceleration characteristics of charge, respectively. Therefore, the speeds of electric fields, magnetic fields, and light fields in a vacuum are equal, which is reasonable and self-consistent. Electric fields, magnetic fields, and light fields cannot be directly excited and transformed. Electric fields, magnetic fields, and light fields are all independent field matter.

Physics is facing great challenges and opportunities, and classical field matter and the quantum world need to be significantly revised.

2. Mechanical waves

A mechanical wave is the propagation process of mechanical vibration in a medium, such as a sound wave or a water wave. To generate mechanical waves, there must first be a vibrating object, which is called the wave source. In addition to the wave source, an elastic medium is also needed. In the elastic medium, the particles are connected to each other by an elastic force, and the particles are involved in the vibration in turn, so the vibration state can spread out and form waves. It can be seen that a wave source and an elastic medium are two necessary conditions for mechanical wave generation. For example, when a person speaks, his vocal cords vibrate. The vocal cord is the wave source and the air is the medium for transmitting sound. Sound cannot propagate in a vacuum.

A mechanical wave is a kind of medium conduction wave that is the propagation process of mechanical vibration in a medium and has the characteristics of reflection, refraction, diffraction, and interference. **A mechanical wave is the phenomenon of the collective movement of many particles participating in vibration at the same time.** The physical principle of a mechanical wave is Newton's classical dynamics, and there is no new physical fundamental principle for mechanical waves. For example, a sound wave is the phenomenon of the collective movement of many air molecular particles.

3. Light fields and single-photon double-slit interference

In 1690, Huygens proposed the wave principle of light, but this theory was soon replaced by Newton's particle theory of light, which stated that light was composed of tiny particles.

In the early 19th century, Thomas Young's light wave double-slit interference experiment provided a new experimental basis for Huygens' wave theory of light. In 1865, Maxwell introduced the "displacement current" hypothesis and theoretically predicted that light was an "electromagnetic wave". Then Huygens' wave theory of light was re-accepted.

In 1905, Einstein solved the riddle of the photoelectric effect and established the wave-particle duality of light. In 1924, De Broglie put forward the "material wave" hypothesis, which stated that all matter has wave-particle duality. According to this hypothesis, electrons also have wave phenomena such as interference and diffraction. This was later confirmed by electron diffraction experiments.

Photons have wave-particle duality. Are photons particles or waves in essence?

Regarding mechanical waves, their reflection, refraction, diffraction, interference, and other wave characteristics are only the phenomenon of the collective movement of many particles participating in vibration at the same time. The essence of a mechanical wave is the movement of particles, and there is no new physical fundamental principle for mechanical waves.

When two strong beams of light cross vertically, photons do not collide and emit outward from the beams. This shows that the photons in the beam are independent of each other, and the volume of a photon itself is relatively very small compared to the space among photons. Thus, the beam is the particle flow of photons, the essence of photons is particles, and photons are a kind of field energy particle with the phase property. The wave characteristics of photons are only the movement phenomena of their phase property. Based on the particle essence and phase property of photons, the light double-slit interference experiment is discussed below.

The double-slit interference experiment is the most important experiment for providing proof of light wave characteristics. Without losing generality, a laser source S is set to emit a parallel laser beam that passes through two parallel slits S_1 and S_2. The parallel beam emitted by S forms a pair of coherent light sources with the same initial phase and the same intensity at double slits S_1 and S_2. The coherent light causes detection screen E behind the double slits to display bright and dark interference fringes. The experimental device is shown in Figure 3.1.

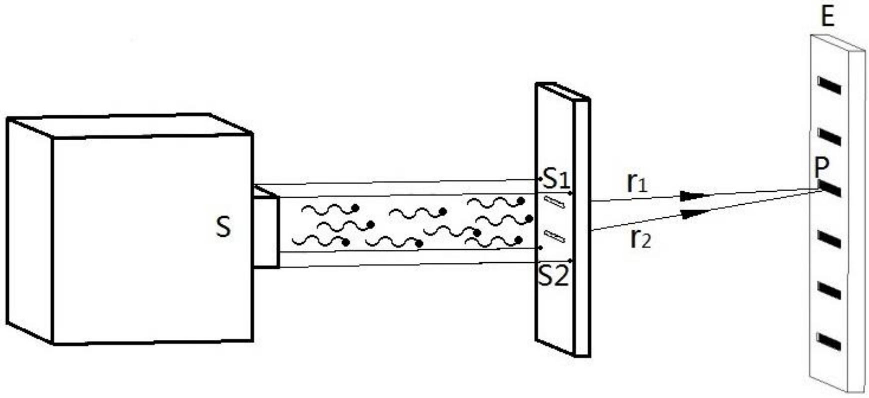

Fig. 3.1 Light beam double-slit interference experiment device

With the assumption that the power of the laser source S is 1.0 w, the cross-section size of the beam is 1 mm x 6 mm, the cross-section size of the double-slits S1 and S2 is 0.02 mm x 4 mm, and the photon wavelength λ= 570 nm, with the frequency of γ= 5.26 x 10^{14} Hz. The energy of one photon is:

$E_\gamma = h\gamma$

$= 6.626 \times 10^{-34} \times 5.26 \times 10^{14}$,

$E_\gamma = 3.487 \times 10^{-19}$ J.

The number of photons emitted by a 1.0-w laser source in 1 second is:

$N_\gamma = 1/ E_\gamma$

$= 1/ (3.487 \times 10^{-19})$,

$N_\gamma = 2.868 \times 10^{18}$.

The number of photons emitted through the 0.02 mm x 4 mm slit in 1 second is:

$n_\gamma = N_\gamma (0.02 \times 4) / (1 \times 6)$

$= 2.868 \times 10^{18} \times 0.00333,$

$n_\gamma = 9.56 \times 10^{15}.$

People's visual retention time for light is 0.05 seconds to 0.2 seconds, and the visual retention time is set to 0.1 seconds. The number of photons passing through two 0.02 mm x 4 mm slits in 0.1 seconds is:

$n_{\gamma 0} = 1.912 \times 10^{15}.$ (3-1)

In quantum mechanics, the single photon double-slit interference experiment is one of the most important fundamental experiments, and its most mysterious and controversial aspect is determining which of the slits S_1 and S_2 a single photon passes through to the detection screen E. Based on the superposition principle, quantum mechanics considers that a single photon passes through the slit S_1 and S_2 at the same time.

Based on the particle essence and the phase property of photons, we further discuss the single photon double-slit interference experiment below.

As shown in Figure 3.2, the laser source S is set to emit one photon at a time. The wavelength of a photon is λ=570 nm and the cross-section size of the double-slits S_1 and S_2 is 0.02 mm x 4 mm, which is the same as that of the experiment illustrated in Figure 3.1. Without losing generality, letting the laser source S emit a photon every 1 pico-second (10^{12} photons are emitted in 1 second), the photons pass through the double slits S_1 and S_2 in turn via different symmetrical paths. The photons passing through slit S_1 are p_1 (i) { i=1,3,5,7...}, and one photon p_1 (i) passes through slit S_1 every 2 pico-seconds. The photons passing through slit S_2 are p_2 (j) {j=2,4,6,8...}, and one photon p_2 (j) passes through slit S_2 every 2 pico-seconds. The initial phases of photons p_1 (i) and p_2 (j) at the double-slit S_1 and S_2 are the same.

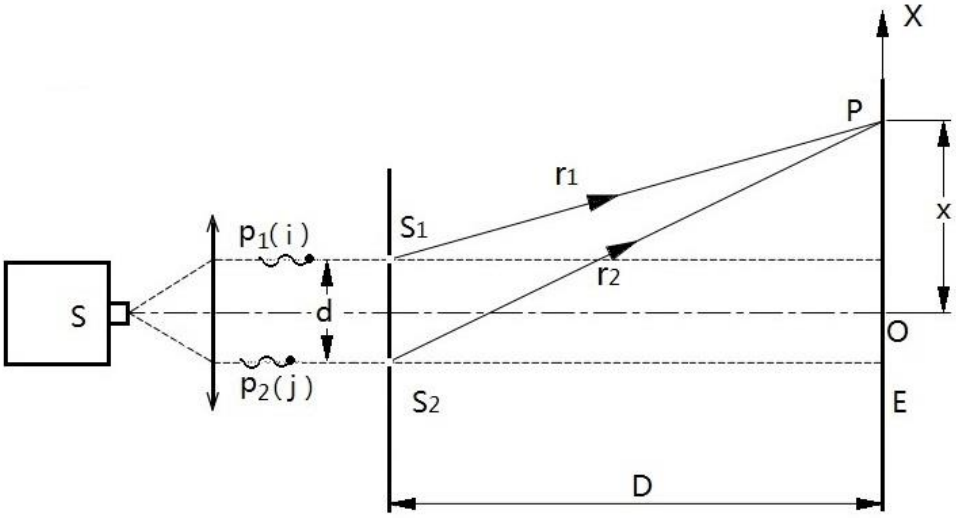

Fig. 3.2 Single photon double-slit interference experiment

It is assumed that the distance between S_1 and S_2 is d and the distance between the double-slit screen and the detection screen E is D. Taking O as the origin, the coordinate axis X is established, a point P (OP=x) on the X axis is selected, and the distances from point P to the double slits S_1 and S_2 are r_1 and r_2, respectively. The optical path difference of photons p_1 (i) and p_2 (j) from S_1 and S_2 to point P is

$$\Delta r = r_2 – r_1. \quad (3\text{-}2)$$

According to Figure 3-2,

$$r_1^2 = D^2 + (x − d/2)^2; \quad r_2^2 = D^2 + (x + d/2)^2.$$

Therefore,

$$r_2^2 − r_1^2 = (r_2 − r_1) (r_2 + r_1) = 2 x d. \quad (3\text{-}3)$$

Because D>>d and $r_2 + r_1 \approx 2D$, according to Equations (3-2) and (3-3):

$$\Delta r = r_2 − r_1 = x d/D.$$

Assuming that the wavelength of photons p_1(i) and p_2(j) is λ, the conditions for the interference enhancement are:

$$\Delta r = x d/D = k\lambda.$$

That is,

$$x = k(D/d)\lambda, k=0, \pm 1, \pm 2, \ldots$$

The positions where the interference between photons p_1(i) and p_2(j) is strengthened are the bright stripes of light. When k=0, then x=0; that is, the origin O is the center of the bright stripe, which is called the central bright stripe. When k=±1, ±2, then x=±(D/d)λ, ±2(D/d)λ. The corresponding bright stripes are the first-level bright stripe and the second-level bright stripe.

If the wavelength of photons p_1(i) and p_2(j) is λ, the conditions for the interference reduction are:

$$\Delta r = x d/D = (2k+1) (\lambda/2).$$

That is,

$$x = (2k+1)(D/2d) \lambda, k=0, \pm 1, \pm 2, \ldots$$

When k= 0, ±1, then x=±(D/2d) λ, ±(3D/2d)λ. The corresponding dark stripes are the zero-level dark stripe and the first-level dark stripe. The bright and dark stripes are arranged at intervals, and the distance between the centers of two adjacent bright stripes (or dark stripes) is:

$$\Delta x= (D/d)\lambda.$$

According to Equation (3-1), the number of photons to be emitted by the laser source S is $n_{\gamma 0} = 1.912 \times 10^{15}$, while the laser source S can emit 10^{12} photons per second. Therefore, the time required for this experiment is:

$$T= 1.912 \times 10^{15}/10^{12},$$

$$T= 1912 \text{ seconds}.$$

According to the above analysis, for the single photon double-slit interference experiment shown in Figure 3.2, a single photon passes through the double slits S_1 and S_2 in turn. There is no superposition principle, and a single photon cannot pass through slits S_1 and S_2 at the same time.

Without losing generality, if the structural parameters of the single photon double-slit interference experiment in Figure 3.2 and those of the parallel beam double-slit interference experiment in Figure 3.1 are the same, the exposure time of the single photon double-slit interference experiment is 1912 seconds and the exposure time of the parallel beam double-slit interference experiment is 0.1 seconds. Then the interference fringes obtained by the two experiments on detection screen E are the same.

Regarding the parallel beam double-slit interference experiment shown in Figure 3.1, assuming that a high-sensitivity camera can observe the photons and take a snapshot of the double-slit every 10^{-16} seconds, it can be observed that the photons pass through the double slits one at a time. That is, continuous beam double-slit interference is also single-photon double-slit interference.

For the single photon double-slit interference in Figure 3.2, according to the superposition principle of quantum mechanics, when a single photon $p_1(i)$ passes through slit S_1, it generates a superposition effect, and $p_1(i)$ passes through slit S_1 and slit S_2 at the same time. Similarly, when a single photon $p_2(j)$ passes through slit S_2, it generates a superposition effect, and $p_2(j)$ passes through slits S_2 and slit S_1 at the same time.

To ensure the experiment in Figure 3.2, a single photon passes through the double slits S_1 and S_2 in turn. We make the following improvements to the experiment shown in Figure 3.2. First, the light shield B_2 is used to block slit S_2, and only slit S_1 is opened. The laser source S emits a photon every 1 pico-second that can only pass through slit S_1. The laser source S emits 9.56 x10^{14} photons to slit S_1 in turn, as shown in Figure 3.3A.

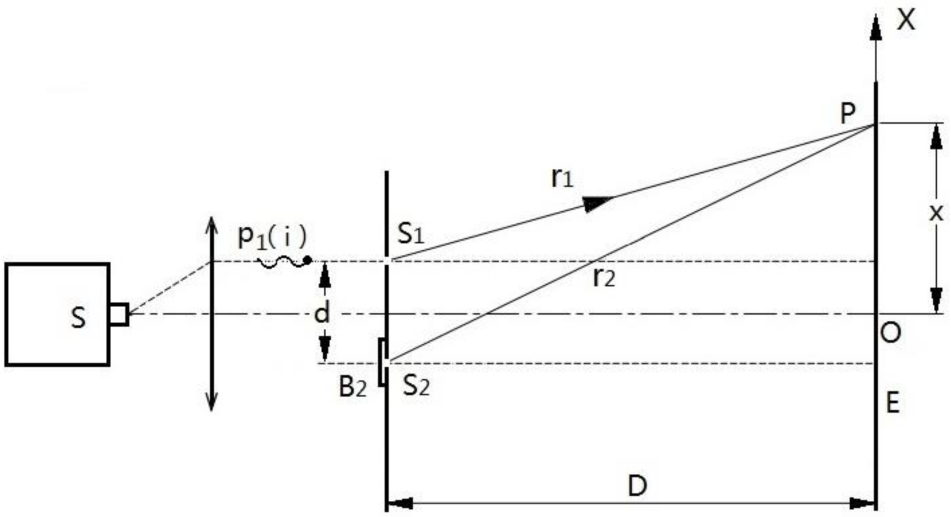

Fig. 3.3A Single photon double-slit interference (S_2 blocked)

Then slit S_2 is opened and slit S_1 is blocked with the light shield B_1. The laser source S emits a photon every 1 pico-second, and the photon can only pass through slit S_2. The laser source

S emits 9.56 x10^{14} photons to slit S_2 in turn, as shown in Figure 3.3B. At this time, the interference fringes on detection screen E should be the same as those in the experiment shown in Figure 3.2.

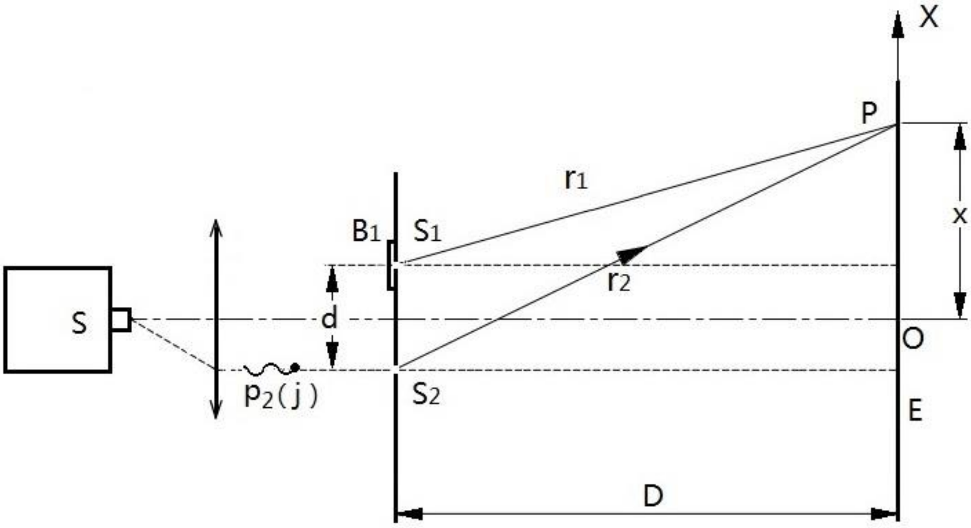

Figure 3.3B Single photon double-slit interference (S_1 blocked)

For the experiments shown in Figure 3.2 and Figure 3.3, the existing single-photon double-slit interference equipment in the laboratory can be used. Step 1: According to the conventional process, slit S_1 and slit S_2 are opened, a single photon double slit interference experiment is conducted, the interference fringes obtained on the detection screen E are saved, and the experiment operation time T_S is recorded. Step 2: First, slit S_1 is blocked with a light shield, slit S_2 is opened, and the same experimental process and operation time T_S in step 1 are used to conduct the single-photon double-slit interference experiment. Then slit S_2 is blocked with a light shield and slit S_1 is opened, and the same experimental process and operation time T_S in step 1 are used to conduct the single-photon double-slit interference experiment again. The interference fringes obtained from step 2 on detection screen E are compared with the interference fringes obtained from step 1 on detection screen E. If the interference fringes are the same, then there is no superposition principle in the single photon double-slit interference experiment; that is, a single photon cannot pass through slit S_1 and slit S_2 at the same time.

For the verification experiments displayed in Figure 3.2 and Figure 3.3, a simpler method is to set a light barrier B between the two slits S_1 and S_2 of the single photon double-slit interference device to ensure that a single photon can only pass through one slit, as shown in Figure 3.4.

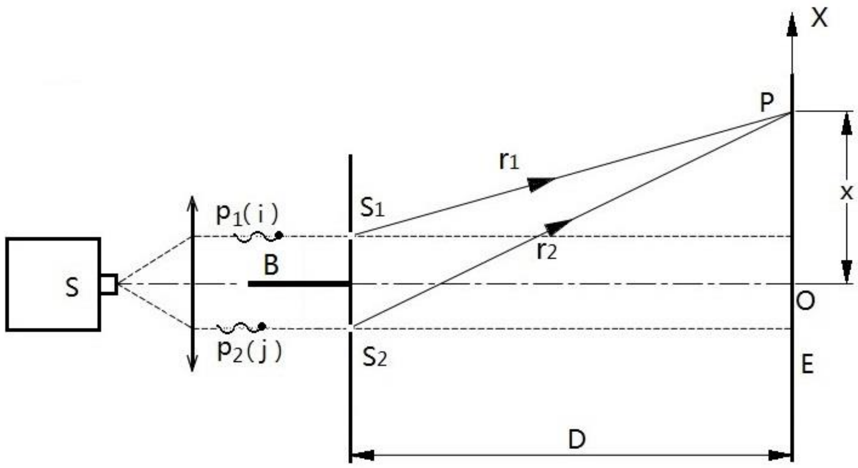

Figure 3.4 Single photon double-slit interference device with a light barrier

The above single-photon double-slit interference experiments in Figure 3.2, Figure 3.3A, Figure 3.3B, and Figure 3.4 are also applicable to other microscopic particles such as electrons.

To summarize, the essence of a photon is a particle, which is a light particle with a phase property. **A light wave is the cumulative phenomenon of the individual movement of a single photon particle with the phase property at different times.** In the single-photon double-slit interference experiment, a single photon cannot pass through double slits at the same time, and a single photon passes through one of the slits in turn to achieve double-slit interference. There is no superposition principle in the single photon double-slit interference experiment. The above theoretical views need to be finally verified by the experiments shown in Fig. 3.3A, Fig. 3.3B and Fig. 3.4.

4. Electric field, magnetic field, and gravitational field

Photons are light particles with the phase property. A light field wave is the emission wave of light particles, and its propagation in a vacuum does not require any medium. Regarding electric field waves, it is assumed that there is a point charge, as seen in Figure 4.1

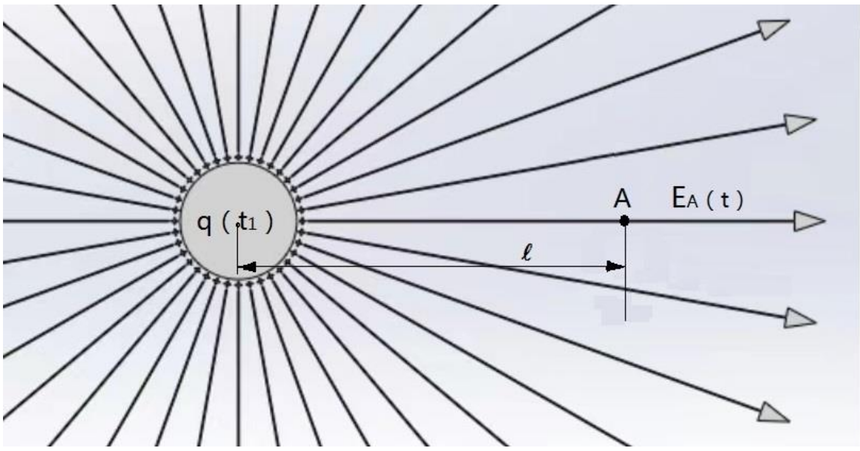

Figure 4.1 Electric field wave excited by periodically varying charge

It is assumed that the amount of charge q (t_1) changes as a sine function:

$q(t_1) = q_0 \sin\omega t_1$.

There is a point A in space, and the distance between point A and the point charge is l. Then the electric field intensity at point A is:

$$\mathbf{E}_A(t) = \frac{q_0 \sin \omega t_1}{4 \pi \varepsilon_0 \ell^2} \mathbf{n}$$

,

where $t_1 = t - l/c$, C is the speed of the electric field, **n** is the unit vector, and its direction is from the charge $q(t_1)$ to point A. Thus, E_A (t) is the electric field wave, which varies as a sine function.

Mechanical waves are medium-conducted waves, and the propagation of a mechanical wave requires a medium. A light field wave is the emission wave of light particles, and the propagation of a light field wave does not require a medium. Is an electric field wave a particle emission wave or a medium-conducted wave?

Assuming that an electric field wave is a particle emission wave, based on the conservation of energy, how long can the energy of a static electron be emitted in electric field quanta? The static mass of an electron:

$m_e = 9.10956 \times 10^{-31}$ kg.

The energy of a static electron:

$p_e = m_e C^2 = 8.198 \text{ x } 10^{-14}$ J.

The charge amount of an electron:

$e=1.602 \text{ x } 10^{-19}$ C.

The electric field intensity at the spherical surface, where r=1 m away from the electron:

$E = k\, e/r^2$

$= 9.0 \text{ x } 10^9 \text{ x } 1.602 \text{ x } 10^{-19}/1^2$,

$E = 1.442 \text{ x } 10^{-9}$ v/m.

The electric field energy density at the spherical surface, where r=1 m away from the electron:

$w = (1/2)\, \varepsilon E^2$

$= (1/2)\, 8.85 \text{ x } 10^{-12} (1.442 \text{ x } 10^{-9})^2$,

$w = 9.20 \text{ x } 10^{-30}$ J/m^3.

The speed of the electric field is C, and the power emitted by the electron in one second is:

$p_1 = (4\pi r^2)\, C\, w$

$= 4 \text{ x } 3.14 \text{ x } 1^2 \text{ x } 3.0 \text{ x } 10^8 \text{ x} 9.20 \text{ x } 10^{-30}$,

$p_1 = 3.467 \text{ x } 10^{-20}$ J/s.

The total energy of a static electron is p_e, which is emitted outward at the power of p_1, and its emission time is:

$$Te = p_e / p_1 = (8.198 \times 10^{-14}) / (3.467 \times 10^{-20}),$$

$$Te = 2.365 \times 10^{6} \text{ seconds} = 656.9 \text{ hours}.$$

Although the above calculation is only an approximate estimate, it can be concluded that if the electric field is a particle emission field wave, when a static electron is left for hundreds to thousands of hours, its energy will be completely consumed and the electron will no longer exist, which must be incorrect. Therefore, an electric field wave must not be a particle emission wave.

When the frequency of a mechanical wave is zero, that is, when the objects involved in the vibration are relatively stationary, the action and reaction forces between objects are equal and opposite, and there is no energy propagation. When the frequency of a mechanical wave is greater than zero, energy can propagate. An electric field wave has the same characteristics as the above mechanical wave description. When a DC power supply is used to charge capacitive bipolar plates, the voltage is constant, the charges of the bipolar plates are relatively static, the electric field action and reaction forces between the bipolar plates are equal, the direction is opposite, and there is no energy propagation. When AC power is used to charge capacitive bipolar plates, an alternating electric field wave is formed between the bipolar plates and there is transmission of the electric field energy. Therefore, it is more reasonable that the electric field wave is a medium-conducted wave.

Magnetic field waves and gravitational field waves have the same characteristics as electric field waves, and they are also medium conduction waves. The mediums of electric field waves, magnetic field waves, and gravitational field waves are defined as electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta. They are all energy quanta with extremely small energy.

To summarize, the following conclusion can be drawn. Electric field waves, magnetic field waves, and gravitational field waves must not be particle emission waves, and it is more reasonable that electric field waves, magnetic field waves, and gravitational field waves are medium conduction waves. The mediums of electric field waves, magnetic field waves, and gravitational field waves are electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta, respectively. A vacuum is filled with electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta. These are particles with extremely small energy.

5. Conclusion

A mechanical wave is a type of medium conduction wave that is the propagation process of mechanical vibration in the medium. **A mechanical wave is the phenomenon of the collective movement of many particles participating in vibration at the same time.** The physical principle of a mechanical wave is Newton's classical dynamics, and there is no new physical fundamental principle for mechanical waves.

In 1905, Einstein proposed the photoelectric effect and established the wave-particle duality of light. This paper reveals that a light wave is an emission wave of light particles. The essence of a photon is a particle, and a photon is a type of field energy particle with a phase property. The wave characteristics of a photon are only the movement phenomenon of its phase property. Based on the particle nature and phase property of photons, this paper theoretically denies the superposition principle of single photon double-slit interference. A single photon cannot pass through the two slits at the same time, and a single photon can pass through one of the two slits in turn to achieve double-slit interference. **A light wave is the cumulative phenomenon of the individual movement of a single photon particle with the phase property at different times.** Furthermore, a verification experiment to check the superposition principle of single photon double-slit interference is presented in this paper. A light shield is used to block one of the two slits, in turn, to ensure that each single photon can only pass through one of the two slits separately.

A light field wave is the emission wave of light particles, and its propagation in a vacuum does not require any medium. A light field wave can propagate in an absolute vacuum without any energy.

Electric field waves, magnetic field waves, and gravitational field waves must not be particle emission waves, and it is more reasonable that electric field waves, magnetic field waves, and gravitational field waves are medium conduction waves. Electric field waves, magnetic field waves, and gravitational field waves require the participation of electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta, respectively to propagate in a vacuum. Electric field medium quanta, magnetic field medium quanta, and gravitational field medium quanta are all particles with extremely small energy.

6. Further work and Prospects

A light wave is the emission wave of a photon, which is a kind of field energy particle with a phase property. What causes a photon to have the phase property?

A photon is an energy particle with spin. When the energy centroid of a photon is eccentric to its spin center axis, according to the law of momentum conservation, the track of a photon is a spiral in space, the pitch of the spiral is equal to the wavelength of the photon, and the spin speed is equal to the frequency of the photon, as shown in Figure 6.1. The typical wavelength of visible light is 570 nm. Hence, the pitch of the spiral in the figure is 570 nm. Modern technology cannot measure the diameter of photons, but the diameter of an electron is about 10^{-13} nm, and the diameter of a photon must be much smaller than that of an electron.

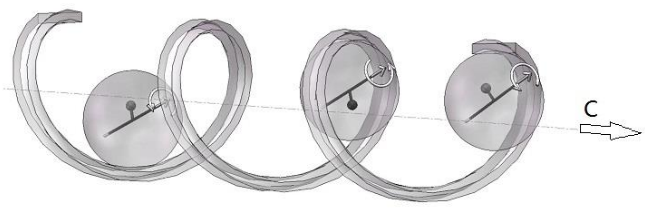

Figure 6.1 Photon phase property caused by eccentric spin

The above-mentioned spiral movement of a photon is caused by its eccentric spin, which cannot explain the polarization of a photon. A reasonable explanation is that the energy centroid of a photon has an eccentric plane vibration, so the track of a photon is a wave curve in its vibration plane, as shown in Figure 6.2.

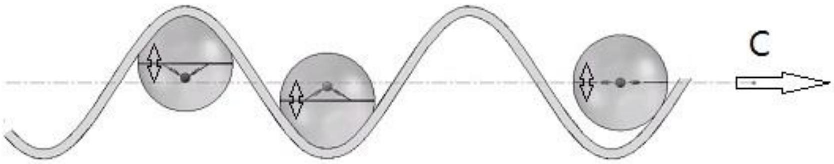

Figure 6.2 Photon phase property caused by eccentric plane vibration

Based on modern quantum observations, there are energy fluctuations in a vacuum field. The vacuum energy fluctuation causes a photon to have the phase property. Just like a boat sailing in the river, it moves up and down with the action of water waves, as shown in Figure 6.3.

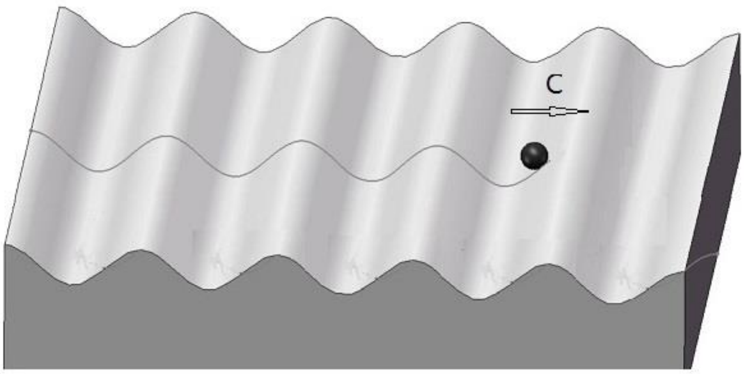

Figure 6.3 Photon phase property caused by vacuum energy fluctuation

The above-mentioned wave properties of a photon also exist in microscopic particles such as electrons. According to Figure 6.1, Figure 6.2, and Figure 6.3, the movement track of photons is a spiral curve with plane fluctuation in space, which is also the movement track of many galaxies in the universe. In the macro physical world, wave characteristics are only the movement external phenomenon of physical matter, and there is no new physical fundamental principle. Regarding the micro quantum world, whether the wave characteristics are also the external phenomenon of quantum motion is not the essence of the quantum world.

The single photon double-slit experiments displayed in Figure 3.2 and Figure 3.3 challenge the superposition principle in quantum mechanics. The question is whether there are more fundamental physical principles of the Heisenberg uncertainty principle, quantum identical principle, and quantum entanglement.

In this paper, the four types of classical physical field matter are divided into particle emission waves and medium-conduction waves. The superposition principle of single photon double-slit interference is denied based on theory, and a verification experiment is proposed.

7. Postscript *

Regarding the single-photon double-slit interference experiment shown in Figure 3.2, the detection screen E behind the double slits displays bright and dark interference fringes. But once the photons are observed, the interference fringes on the detection screen E immediately become two bright fringes, and the photons no longer interfere， when the observation is abandoned, interference fringes appear again on the detection screen E. It seems that photons have spirituality to perceive whether they are being observed. In order to explain this strange phenomenon, the Copenhagen School proposed the quantum collapse principle: Once the photon is observed, the quantum collapse of the photon occurs, and the photon will enter into a certain state from an uncertain superimposition state. At this time, a single photon can only pass through one slit, and no interference fringes will appear on the detection screen.

Based on the particle nature and phase property of photons, we know that the basic condition of the photon interference is coherent photons, that is, the initial phase of photons at the slits is the same. The observation of photons must apply force to photons and involve momentum exchange each other. Thus, the initial phase of photons is changed, and the photons at the slits are no longer coherent photons. Assume that the emission photon is a purple photon with a wavelength of 380nm, and the observation photon is a red photon with a wavelength of 700nm, the energy between them is on the same order of magnitude. The red observation photons have a big influence on the phase of purple emission photons, and interference fringes will not appear on the observation screen. If the emitted photon is a high-energy X-ray photon with a wavelength of 1nm, its energy is hundreds of times that of the red photon. The red observation photon has a little influence on the phase of the high-energy X-ray photon, and interference fringes will still appear on the observation screen.

* "7. Postscript" is added to the article in this version 2.0

Author: Hongyuan Ye hongyy@buaa.edu.cn

Availability of Data and Materials:

All data generated or analysed during this study are included in this published article and its supplementary information files.

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