Photon

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Abstract

In the text "Photon", I propose the hypothesis about what the photon is and how the photon interacts with electric charge. Unlike the other three omnidirectionally propagated forces (electrostatic force, magnetic force, and gravitational force), the light is the only unidirectionally propagated force, and the photon is the elementary (minimum) unit of light. And I also suggest a new version of Double-Slit Experiment to prove my idea.

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Keywords

Photon; collide; force

1. Introduction

The purpose of this text is to propose a hypothesis about what light is and how light interacts with matters. Because existing optical theories are so confusing and their answers about the nature of light are conflicting, this text aims to propose an explanation that can clearly elucidates what the nature of light is, and then analyzes how individual photons interact with electrons or protons.

2. Flaws in Existing Theories about Light and Photons

Existing theories about what light is and how light interacts with other matter are so confusing that we don't actually have a single theory right now to explain all the phenomena of light. In the text below, I list some of the flaws in existing theories explaining light:

Firstly, light or photons are not entity particles (matter particles) because:

(1) Photons do not have the properties possessed by entity particles such as electrons and protons, and these properties are electric charge, mass, and magnetic charge;

(2) The photon propagation speed does not change, which is not the same as the behaviour of entity particles.

Secondly, light or photons are not electromagnetic waves either because:

(1) Because electromagnetic waves are wave forms that is created by the propagation of electrostatic force and magnetic force. For example, there is an electric charge. When the electric charge moves, the electric field around it will change with its movement, presenting a wave form;

(2) Electric or magnetic fields, whether at rest or in motion, do not produce magnetic or electric fields. For example, if the electric field around an electric charge changes due to the motion of the electric charge, no magnetic field will be produced. No such experiment can prove the existence of such an effect. Similarly, for example, there is a magnet. If the surrounding magnetic field changes due to the movement of the magnet, it will also not produce an electric field;

(3) If light is electromagnetic wave, then we can place a magnet around a beam of light. Then if a beam of light is propagated by alternation between electric fields and magnetic fields, then applying a magnetic field or an electric field on the beam will definitely affect this beam of light. But in the real world, we do not see any disturbance to light due to the application of magnetic and electric fields;

(4) Light does not attenuate with the increase of propagation distance, while electricity and magnetic force will attenuate with the increase of distance. This phenomenon is ubiquitous in daily life. Existing theories do not explain why the propagation of light does not attenuate with distance;

(5) The propagation of light is unidirectional, while the propagation of electric and magnetic fields is omnidirectional. Therefore, if light is electromagnetic wave, the many optical phenomena such as reflection and refraction of light cannot be explained;

Thirdly, the existing theories cannot explain the interaction of photons with electrons:

(1) Moving electron will emit photons, but electrons are always in motion, when will photons be emitted? The accelerated electrons emit photons, so how fast is this acceleration and how long does the acceleration take to emit photons?

(2) When electrons emit photons, does it emit one photon or multiple photons at a time? Do the emitted photons propagate in one direction or in all directions (omnidirectional)?

(3) The emitted photons carry energy, why electrons can emit photons of different energies? And what is the mechanism for this? Besides, "energy" doesn't really exist, it's just a concept created by human.

(4) What happens when a photon encounters an electron? How does the photon transfer the carried energy to the electrons? Is there interdependence between the direction of propagation of photons and the direction of motion of electrons?

Nonetheless, the above questions will be answered in my hypotheses below.

3. The Nature of Light

What is light? Light is a special force, why do you say so, because photons do not have mass, electric charge and magnetic charge, and the speed of propagation is the speed of light (its speed is the same as the speed of propagation of electrostatic force, magnetic force and gravitational force, so it shall be said that the propagation speed of force is the speed of light), and its effect is to cause entity particles to move (for example, we feel warm when the sunlight is on our body), so if light is not force, what else is it? So light is a kind of force, and a single photon is the fundamental unit of light, and a ray is made up of a huge number of photons moving in the same direction. But light is the only unidirectional force, which is very different from the other three omnidirectional forces (electrostatic force, magnetic force, and gravitational force). Moreover, when photon interacts with particle, it is also very different from the other three omnidirectional forces. The propagation direction and magnitude of omnidirectional forces will not be affected when they encounter particles. In other words, the interaction of omnidirectional forces with particles only tells the particles how to move, without changing the forces, as if there is no particle. As a unidirectional force, the photon will change its propagation direction after encountering the particle, but the magnitude of the force

it carries will remain the same. When a particle encounters a photon, it will also receive the force carried by the photon and change its motion.

4. Interaction of Photons with Electrons or Protons

(1) The process of a photon emitting by one electron (or proton, omitted below) and colliding with another electron is as follows: Suppose that in a space, one electron E moves from position 1 to position 2 in one timebase (T0), and moves from position 2 to position 3 in the next timebase (T1). Suppose that electron E is being acted upon by many forces at position 1, including electrostatic force, magnetic force, and gravitational force, and these forces will merge into only one resultant force with only one direction at position 1. Suppose that the direction of this resultant force at position 1 is from position 1 pointing to position 2, and the magnitude of this resultant force can drive electron E from position 1 to position 2. Then electron E emits this resultant force as a photon P1 from position 1, the direction of photon movement is from position 1 pointing to position 2, that is, the direction of the resultant force electron E receives at position 1, and the magnitude of the force carried by the photon P1 is the magnitude of this resultant force. Then when electron E moves from position 1 to position 2, the resultant force it receives at position 2 will be emitted as another photon P2, and its direction and magnitude are exactly the same as the resultant force at position 2. The electron changes its position once in each timebase, namely, moving from one position to another. When arriving at a new position, the electron will emit the resultant force at that position in the form of one photon, as shown in the Figure 1 below.

(2) The photons emitted by electrons move along the direction of the resultant force at the speed of light, that is to say, photons change their position once each timebase and their direction do not change. When a photon encounters another electron, it not only transfers the force it carries to the electron, but also changes the direction of propagation because of the electron. As shown in the Figure 2 below, photon P1 collides with electron E at position 1, changes direction and continues to move in the direction of P2 (P1 and P2 is the same photon). The force carried by photon P2 is the same as that of P1. That is to say, since the photon is emitted from the original electron, the magnitude of the force the photon carried will not change, only the propagation direction of the photon changes.

When the resultant force carried by photon P1 reaches position 1 where electron E is located, it will form an angle with resultant force R electron E receives at position 1, which is the included angle between P1 and R (incident angle) in the Figure 2 below. Then after photon P1 encounter the electron, it changes direction and continues to move as P2. The moving direction of P2 is twice the included angle between the two resultant forces. Namely, the included angle between P1 and R is equal to the included angle between P2 and R (reflection angle) in the following Figure 2. At the same time, electron E emits the resultant force R it receives at position 1 as a photon P3 (new photon). The resultant force R received by electron E at position 1 includes the force carried by photon P1, and various omnidirectional and unidirectional forces emitted by other particles. Therefore, the electron not only emits omnidirectional force at each timebase, but also emits the resultant force it receives in the form of unidirectional force.

The above speculation is based entirely on many optical phenomena, including reflection, refraction and diffraction, total reflection, rhomboid spectroscopy, spontaneous emission and stimulated emission, Compton scattering, synchrotron radiation, photoelectric effect, Casimir effect, Hong-Ou Mandel effect and cosmic microwave background radiation. As an explanation for the mechanism of light, the above-mentioned mechanism must be able to explain all light phenomena. For example, the reduction in the propagation speed of light in the medium is caused by the turning and lengthening of the propagation path of photons due to colliding with electrons. Another example is the wavelength and frequency of light mentioned in the current optics theory, which are actually the behavioural patterns of a large number of photons. For example, gamma rays are caused by the violent movement of emitting electrons, and the violent movement of electrons is because the resultant force on these electrons is very high, so the force carried by the gamma-ray photon is also great. The success of a hypothesis lies in whether it can explain all phenomena, not some of them. I cannot be sure that I have checked all the optical phenomena and experiments, but the phenomena I listed above can be explained well with this mechanism.

4. New Double-Slit Experiment

Next I want to design an experiment to prove my conjecture, and also want to show how confusing the current optics theories are. For a long time, light has been interpreted as waves due to interference and diffraction phenomena, and entity particles have also been interpreted as waves due to the interference of electrons and other particles. There is no such thing as "wave" in the real world. A "wave" is just the pattern of movement of a large number of tiny components. Moreover, phenomena such as interference and diffraction of electrons or other particles do not prove that matter has wave property. On the contrary, it proves the corpuscular property of photons. It shows that photons and particles move in the similar way. It's just that we have been misled by the concept of "wave" for a long time and have come to a wrong explanation. However, a photon is not a particle too, but a kind of "Force", which exhibits different behaviours when interacting with matter as compared with particles. When a particle collides with a particle, its momentum will change, but when a photon collides with a particle, the magnitude of the force it carried will not change, only the direction will change.

We can look at the famous double-slit experiment [1] in which we interpret interference fringes as evidence of waves. Photons, electrons, and other larger particles passing through the double slits can produce interference fringes, but such fringes are precisely because the photons or particles collide with the electrons in the edge of the shield slit, causing the direction to be deflected, and then fringes appear on the receiving screen. If we want to prove that the fringes are caused by the deflection of photons when they collide with electrons, rather than the waves, we can change the material at the edge of the shield slit. The aim is to change the arrangement of electrons in the edge, so that the deflection of photons is different after the collision, which will provide different fringes on the receiving screen, as compared with the edges not changed. And then it can be found that the change of the fringes is positively correlated with the structural change of the edge material. Specifically, we can change one edge of each slit, two edges of one slit, or the shape of the edge. The method is to select materials with a large difference in the number of electrons and arrangements of electrons, or to heat or energize the materials in one or two edges. In short, it is to change the edge microstructure, so that it can be proved that the fringes are not caused by particles or photons themselves. It is caused by the interaction of photons with the particles in the edge of the slits. At the same time, it can be found that the results of the double slit experiment between photons and electrons or other particles are different, because the force carried by photons will not be changed, while the momentum of other particles will be changed after they pass through the slits. We can measure the magnitude of photons and particles directly hitting the receiving screen without passing through the double slits, and then measure the magnitude of photons and particles hitting the receiving screen through the double slits, and we can find that the magnitude of photons will not change, but the particles will change, so this proves that photons are neither waves nor particles.

A serious problem with many of our experiments involving microscopic particles is that we are still using the thinking for macroscopic world, that is, the experimenters believe that the experiment is reproducible and the experimental conditions are reproducible. Such an idea is feasible in macroscopic experiments, because changes on the microscopic scale have little impact on macroscopic objects. But for experiments involving microscopic particles, we must realize that the conditions of each experiment are changing, because all experimental sites, environments, equipment and materials, and even experimenters are composed of microscopic particles, and these microscopic particles are in motion all the times. In fact, we are using a large group of constantly moving microscopic particles to measure or manipulate a small group of constantly moving microscopic particles, so the results of such experiments must be different every time. Therefore, for experiments involving microscopic particles, no matter how to control the experimental conditions, there will be some differences, and these differences will lead to variety in experiment results. If we believe that the experimental conditions and processes are exactly the same, and just obtain different results, then we can only use Quantum Theory as an explanation that abandons the law of causality.

5. Conclusion

All forces propagate at the speed of light, and light is a unidirectional force, similar to the other three

omnidirectional forces (electrostatic, magnetic, and gravitational forces). This hypothesis can not only explain many optical phenomena, but also help to understand the behaviour of other particles.

CRediT authorship contribution statement

Huan Liang wrote the original draft and final version of above paper.

Declaration of Competing Interest

The author did not have any conflict of interest.

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Data Availability Statement

All data, models, and code generated or used during the study appear in the submitted article.

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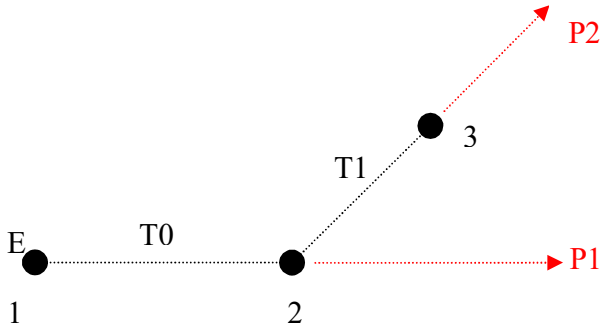

Figure 1: Electron emits photon

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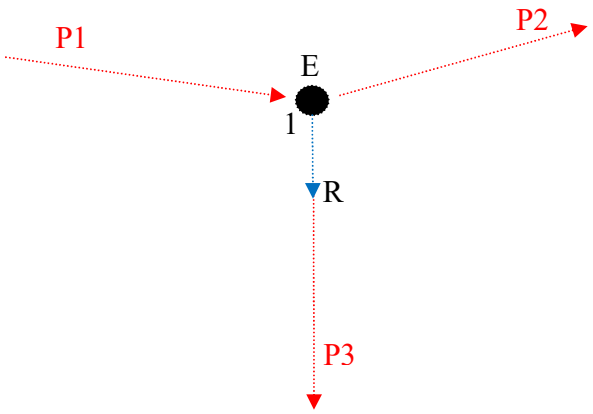

Figure 2: Photon encounters electron

The above speculation is based entirely on many optical phenomena, including reflection, refraction and diffraction, total reflection, rhomboid spectroscopy, spontaneous emission and stimulated emission, Compton scattering, synchrotron radiation, photoelectric effect, Casimir effect, Hong-Ou Mandel effect and cosmic microwave background radiation. As an explanation for the mechanism of light, the above-mentioned mechanism must be able to explain all light phenomena. For example, the reduction in the propagation speed of light in the medium is caused by the turning and lengthening of the propagation path of photons due to colliding with electrons. Another example is the wavelength and frequency of light mentioned in the current optics theory, which are actually the behavioural patterns of a large number of photons. For example, gamma rays are caused by the violent movement of emitting electrons, and the violent movement of electrons is because the resultant force on these electrons is very high, so the force carried by the gamma-ray photon is also great. The success of a hypothesis lies in whether it can explain all phenomena, not some of them. I cannot be sure that I have checked all the optical phenomena and experiments, but the phenomena I listed above can be explained well with this mechanism.

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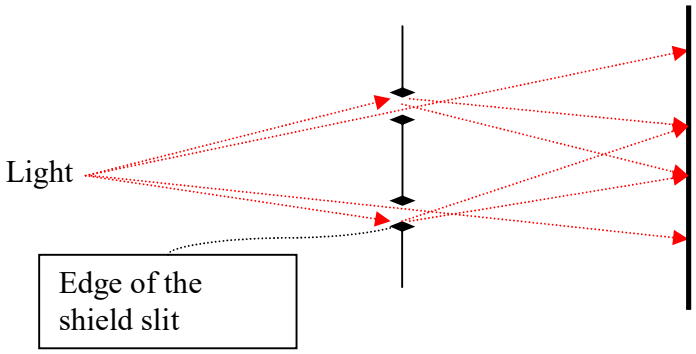

Figure 3: Double-Slit Experiment

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CRediT authorship contribution statement
Huan Liang wrote the original draft and final version of above paper.

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The author did not have any conflict of interest.

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Data Availability Statement
All data, models, and code generated or used during the study appear in the submitted article.

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