The law of interaction between light and media proves that light is neither an electromagnetic wave nor a photon nor a wave-particle duality

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[Article Abstract]: The interaction of light with a medium changes all the characteristics of light, including but not limited to the direction of light transmission, the phase of light, the amplitude of light, the frequency of light, the wavelength of light, the speed of light and so on. However, people's understanding of what light really is is still not completely unified, there are those who think light is electromagnetic wave, there are those who think light is photon, and there are those who think light has wave-particle two-phase nature. Through my long time research found: from the existence of reflected light half-wave loss, polarization refraction light Faraday magneto-optical effect, single-slit diffraction light intensity change four laws, double-slit interference phenomenon, Seeman effect, medium surface state determines the phenomenon of absorbance, the speed of light at the interface of different media jump and uniform medium internal speed of light relative to the medium itself speed constant and other phenomena after comprehensive analysis can be concluded: light is neither electromagnetic waves, nor photons, and there is no wave-particle duality. Light should only be one of the manifestations of the Coulombic and magnetic interactions between charges, and cannot be an object that can exist independently of the charge/light source. In this paper, we focus on the relevant issues with the chain of evidence formed by many evidences of the law of light-medium interaction, with a view to correcting the current misconceptions about the nature of light. Also, the results of several light-related physical experiments, such as the Michelson-Morley experiment, the photoelectric effect and the Compton effect, are explained in terms of the light-dielectric interaction law.

chapter one

The complete chain of evidence fully demonstrates that the law of light-medium interaction is that incident light makes the medium a secondary source of light

First, he mechanism of half-wave loss generation and the validity of evidence for the presence of reflected light

When the incident light is a sinusoidal wave, i.e. the electric field strength (normalized by the Coulomb force) is $E=A\sin 2\pi ft$, the Coulomb force exerted on the electrons and nuclei of the atoms in the medium is in the opposite direction, and therefore the acceleration exerted on the electrons and nuclei is also in the opposite direction, i.e. the atoms will be polarized into an electric dipole. The dipole moment of the electric dipole lags behind the phase of the incident light by exactly half a period: since the acceleration of the electron and nucleus is in phase with the incident light; the velocity of the electron and nucleus lags behind the incident light by 1/4 of a period, i.e.,

△V∽-Acos2πft; the displacement of the electron and nucleus lags behind the incident light by half a period, i.e., △s∽-Asin2πft. The electric dipole of the polarized atom produces The phase of the secondary light generated by the polarized atomic electric dipole is synchronized with the dipole moment of the electric dipole. Therefore, the phase difference between the secondary light and the incident light is half a period. This is the mechanism for the so-called half-wave loss of reflected light. As shown in Figure 1 below：

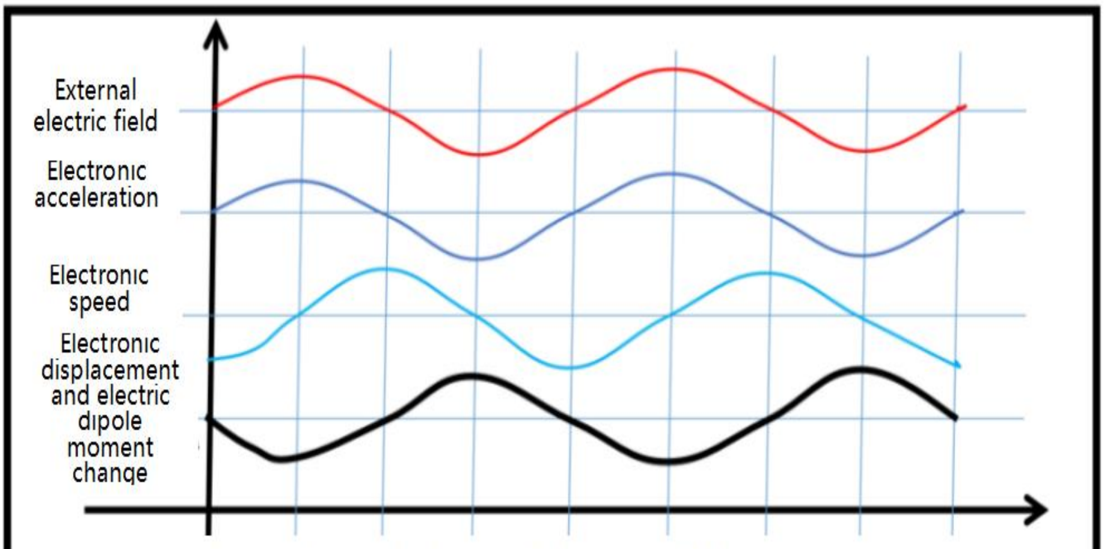


Figure 1: Schematic diagram of the motion of electrons in an atom under the action of external electric field and the change of electric dipole moment

The half-wave loss mechanism is a direct proof that the reflected light is part of the secondary light generated after the medium is polarized by the incident light into a secondary source.

Second, Mechanism of the Faraday magneto-optical effect in the presence of polarized refracted light and the validity of the evidence

From ψ=VBd, we can know that Faraday magneto-optical effect is proportional to the external magnetic field strength b and the length d of transparent medium. That is to say, when the external magnetic field and/or transparent medium do not exist, there is no such effect. It can be seen that this effect is not completed by the external magnetic field alone, nor by the medium alone, but by the cooperation of the two. Since the magnetic field cannot directly change the polarization direction of light, it is certainly impossible to change the polarization direction of refracted light inside the medium; The medium can not change the polarization direction of refracted light without the cooperation of external magnetic field. There is only one possibility left, that is, in the process of regenerating light by atoms in the medium, the applied magnetic field changes the direction of motion of electrons and nuclei, which causes the polarization direction of secondary light generated by them to change, so that the polarization direction of secondary light and incident light is slightly different, which leads to the change of the direction of polarized refracted light. This is the mechanism of Faraday magneto-optical effect of polarized refracted light.

This phenomenon is ample proof that refracted light is part of the secondary light produced by the medium.

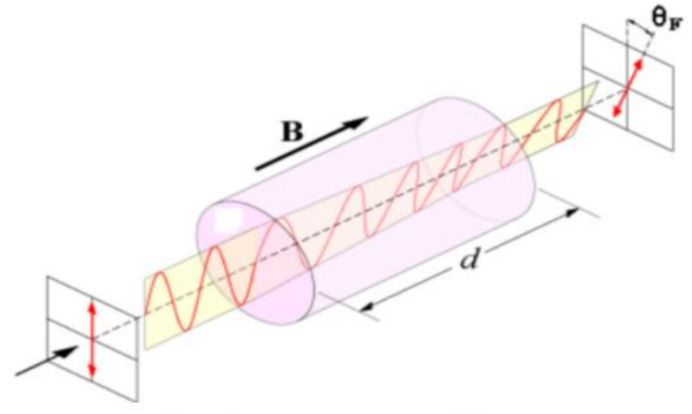


Figure 2: Schematic diagram of the Faraday magneto-optical effect of polarized refracted light

Third, Determinants of single slit diffraction light intensity variation law and the validity of the evidence

There are four major rules for the variation of single-slit diffracted light intensity: first, there are light and dark stripes similar to interference phenomenon; second, the distance between diffracted light and dark stripes is inversely proportional to the single-slit width; third, the maximum value of diffracted light intensity is generally not greater than 20% of the direct light; fourth, when the single-slit edge is covered with super black material or the direct light does not irradiate to the single-slit edge, the diffracted light intensity is 0.

1、The intensity of diffracted light shows similar interference of bright and dark stripes

As shown in Figure 3 below: the intensity variation of diffracted light shows obvious light and dark zoning, which is basically the same as the double slit interference image.

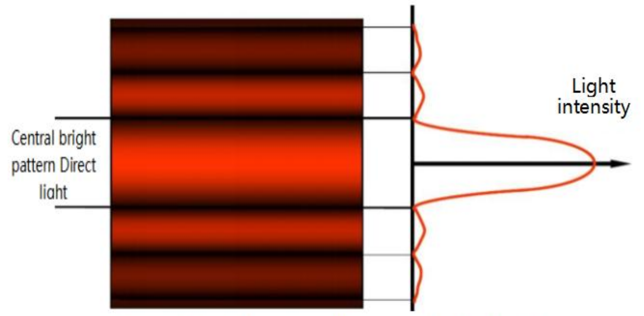


Figure 3: Schematic diagram of single slit direct light and diffracted light intensity variation

2、The spacing between the light and dark stripes of diffracted light is inversely proportional to the width of the single slit

When the single slit width is b, the vertical distance from the single slit to the screen is H, and the wavelength of the direct light is λ, then we have: the single slit diffracted light streak spacing $\triangle S$ is:

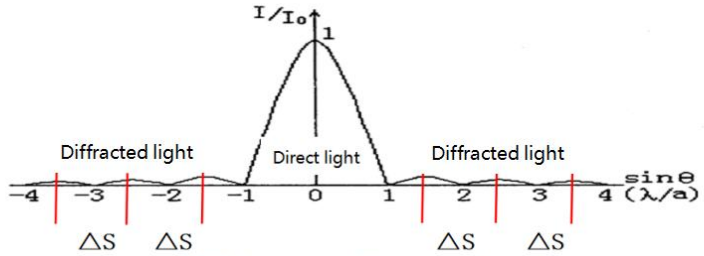


Figure 4: Schematic diagram of single slit diffraction light intensity variation

$$\Delta S = \frac{\lambda H}{b} \qquad \text{(Formula 1)}$$

From (Formula 1) it is known that: the spacing between the bright and dark stripes of single slit diffracted light is proportional to the wavelength of the direct light, the vertical distance from the single slit to the screen, and inversely proportional to the single slit width.。

3、The intensity of direct light is more than 5 times the intensity of diffracted light main flap

As shown in Figure 4 above: the intensity of the direct light is more than 5 times the intensity of the diffracted light main flap, while the intensity difference of the diffracted light 1st, 2nd and 3rd flaps is smaller, and the intensity difference should be within 20%。

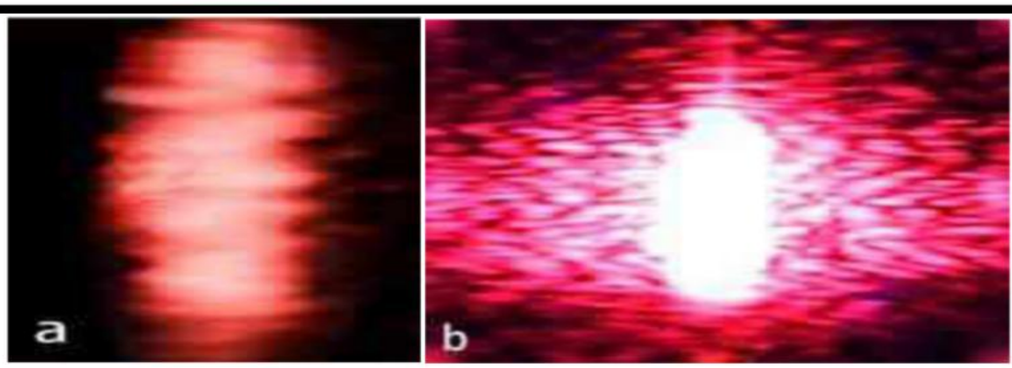
4、No diffracted light when direct light is not irradiated to the edge of the single slit or when the edge of the single slit is covered with super black material

4.1、No diffracted light when the light is not irradiated to the edge of the single slit

Mr. Ji Hao pointed out in the article "A New Study of Diffraction and Interference" that "In addition, we found that when one side of a single slit is irradiated by a laser, a straight-edge diffraction image will appear, and when the other side is gradually approached, a clearer diffraction image will generally appear when the laser irradiates this side, but the condition is that the light source must irradiate both sides of the slit at the same time, otherwise, even if the width of the slit is small enough to produce the geometry of a single slit diffraction, only a straight-edge diffraction image will appear on one side, and no clear diffraction image will appear".

4.2. No diffracted light when covering the single slit edge with super black material

In the article "New Discoveries in Optical Experiments", Mr. Yang Facheng disclosed the experimental result that there is no diffracted light after covering the single slit edge with super black material, as shown in Figure 5 below:



(a) Demonstration of a bright line on the observation screen (b) Camera facing a single slit to take a photo

Figure 5: Photos of optical experimental results when covering the single slit edge with super black material

It can be seen that two factors determine the variation pattern of diffracted light intensity: first, the characteristics of the single slit edge (regenerative light capacity); and second, the single slit spacing (the distance between two secondary coherent sources). As shown in Figure 6 below：

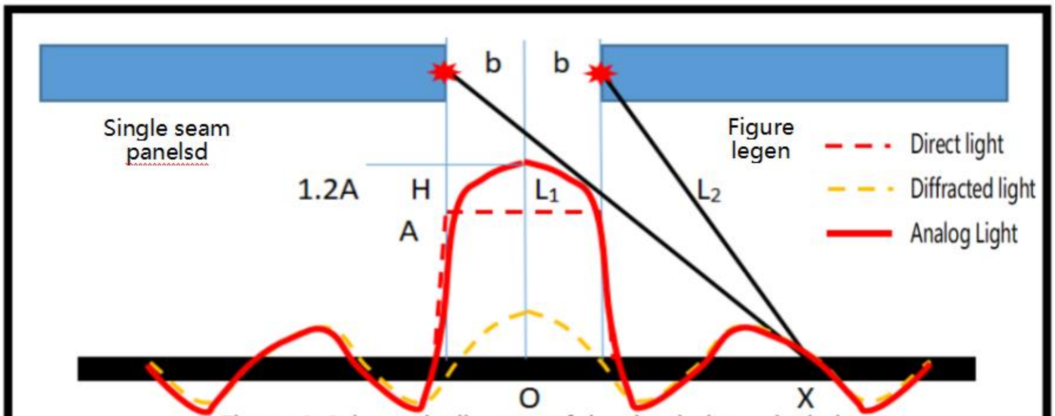


Figure 6: Schematic diagram of the simulation calculation of the experimental results of single-slit diffracted light

These characteristics of the diffracted light intensity are sufficient evidence that the diffracted light is part of the secondary light generated at the edge of the single slit.

Fourth, Determinants of double-slit interference light intensity variation law and the validity of the evidence

Double-slit interference light intensity change law: there are alternating light and dark interference stripes. In fact, double-slit interference is only the case when two single slits are close to each other, and there is no essential difference with single-slit diffracted light. Therefore, the so-called interference light is only a part of the secondary light produced by the slit fringe, which is the result of vector superposition of secondary light produced by two groups of four mutually parallel slit fringes.

Fifth, Seaman Effect and Evidence Validity

The Seeman effect is the phenomenon of splitting and polarization of spectral lines emitted by atoms in an external magnetic field, that is, an applied magnetic field causes atoms to produce more polarized light with characteristic spectral lines of different frequencies. The phenomenon of spectral lines splitting into three was first observed historically and given a theoretical explanation.

We can consider the applied constant magnetic field as a special kind of incident light → constant magnetic force without Coulomb force. When this magnetic force is applied to the medium, there are three possible changes in the electrons in the atoms inside the medium depending on the angle (assumed to be θ) between the plane of motion normal to the nucleus and the direction of the applied magnetic force: when $0° < \theta < 90°$, the speed of the electrons around the nucleus decreases as a result, leading to a decrease in the frequency of the electromagnetic radiation produced (redshift of the spectral lines); when $\theta = 90°$, the speed of the electrons around the nucleus remains unchanged (corresponding to the spectral line when no external magnetic field is applied); when $90° < \theta < 180°$, the electron velocity around the nucleus increases as a result, leading to an increase in the frequency of the generated electromagnetic radiation (spectral line blue-shift). Thus, the spectral lines produced by the medium appear to split into three under an applied constant magnetic field.

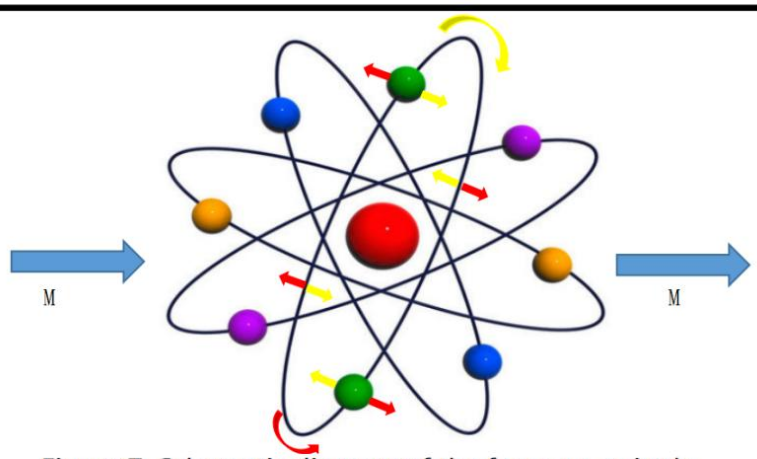


Figure 7: Schematic diagram of the force on a single electron in an applied horizontal constant magnetic field

It follows that, like the incident light exerts a changing Coulomb force and magnetic force on the medium, when a constant magnetic force is applied to the medium, the properties of the light produced by the medium will also change as a result. This proves from one side that the law of light-medium interaction is that the incident light changes the luminous properties of the medium and produces different secondary light.

Sixth, the media surface state determines the phenomenon of absorbance and the effectiveness of the evidence

The light absorption rate of graphene is generally 2~3%. But through a special process to make its surface produce a certain texture will become a super light-absorbing material, its light absorption rate of up to 90% or more of the phenomenon shows that: reflected and scattered light is not as simple as the surface of the medium to reflect and scatter the incident light, otherwise, when the shape of the reflective interface changes, the total intensity of reflected and scattered light should not change significantly, will only change the direction of reflected and scattered light due to the different shapes of the interface and intensity ratio.

The phenomenon that some special treatment of the surface of the medium will drastically change the absorbance of the medium shows that: reflected and scattered light is not the surface of the medium to reflect or scatter the incident light, but the medium re-generates the light. When the surface shape is different, the result of the superposition of the secondary light produced will naturally be different. When half of the secondary light and the other half of the secondary light phase difference of exactly half a period, the superimposed results will cancel each other and disappear. This is the internal reason for the huge change of absorbance when the shape of the medium surface is different.

The phenomenon that different media surface properties lead to huge changes in the absorbance (total intensity of reflected and scattered light) of a material proves that the absorbance of a material is not the ability of the material to absorb light, but the phase change of the secondary light it produces leads to a dramatic change in its total intensity of reflected and scattered light.

Seven,The ubiquitous phenomenon of light transformation and the validity of the evidence

People will find in daily life: under the same sunlight, everything on the surface of the earth has ten thousand different colors. This is a natural phenomenon that is not well explained by light being either electromagnetic waves or photons. If light is electromagnetic waves or photons, the reflected and scattered light from different media surfaces with the same flatness should not show big changes, and the colors should not change a lot. In particular, the same by the carbon atom composition of graphite and diamond, in the case of its surface flatness of the same, in the same source of light generated by the light to its surface, the reflected and scattered light should be basically the same, but in fact is not. Graphite is a black opaque body, while diamond is a transparent body. This is a phenomenon that is difficult to explain with light is electromagnetic waves or photons. But it is well explained by the fact that reflected and scattered light, refracted light and transmitted light are all secondary light generated by the medium: because of the different molecular and atomic arrangements of graphite and diamond, the result of vector superposition of secondary light generated by each of their atoms and molecules as a source of secondary light in spatial position is naturally different. The vector superposition of graphite results in a black color without much reflected and scattered light, while the vector superposition of diamond results in a transparent body with strong refracted light.

The reason for the strange color of the surface of various substances in nature is that the frequency of the vector superposition of secondary light produced by atoms and molecules of a certain range of thickness of their surface layer, which becomes a secondary light source under the action of incident light, is different from that of the incident light. This is the most common phenomenon of light conversion - the phenomenon that the frequencies of reflected and scattered light appear to change dramatically from the incident light.

This frequency variation phenomenon of reflected and scattered light is ample proof that reflected and scattered light is part of the secondary light generated by the medium.

Eight,The main factors determining the speed of light in the medium and the validity of the evidence

As shown in Figure VIII below: Assuming that the speed of light in water is V1 = 225,000 km/s, the speed of light in glass is V2 = 200,000 km/s, and the speed of light in air is V0 = 300,000 km/s, then the speed of light at the intersection of different media varies as follows.

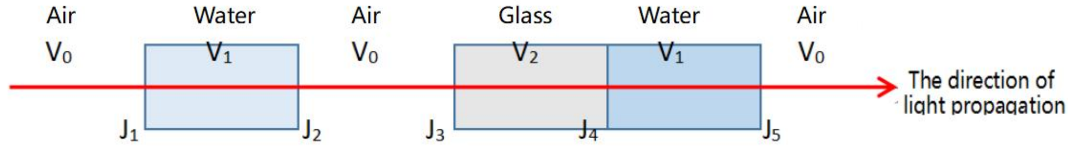


Figure 8: Schematic diagram of the variation of the speed of light in different media

The speed of light at interface J1 decreases from 300,000 km/s to 225,000 km/s; the speed of light at interface J2 jumps from 225,000 km/s to 300,000 km/s; the speed of light at interface J3 decreases from 300,000 km/s to 200,000 km/s; the speed of light at interface J4 jumps from 200,000 km/s to 225,000 km/s; the speed of light at interface J5 jumps from 225,000 km/s to 300,000 km/s at interface J5. The speed of light inside the medium is constant with respect to the speed of the medium itself。

The speed of light inside the above homogeneous medium is constant and has nothing to do with the speed of incident light, but the speed of light at the intersection of different media can change abruptly or even rise abruptly, which is difficult to explain the phenomenon of light is a photon. With light is an electromagnetic wave to explain the words, also have to identify the electromagnetic wave is generated by the medium or in the medium of electromagnetic wave transmission speed is different. But the refracted light inside the medium for the secondary light generated by the medium is very good to explain this phenomenon: different media, the number of regeneration of light per unit length is different, when the medium is uniform, the number of regeneration within the length of a single slit is the same, although each regeneration needs to consume half a cycle of time, but the total time required to consume per unit length is the same. Therefore, the speed of refracted light inside a uniform medium is the same. However, the number of regeneration of refracted light per unit length in different media is different, and all the speed of light is different.

The speed of refracted light is determined by the properties of the medium sufficient proof: the refracted light inside the medium is part of the secondary light generated by the medium。

Nine, thin film interference and rainbow phenomenon mechanism and evidence validity

When the sunlight hits the film and the cloud composed of small water droplets suspended in the air, the film and the droplets become secondary light sources, and the secondary light generated by atoms, molecules and molecular clusters (which can be referred to as "polarized bodies") in different parts will follow the principle of vector superposition and form a superposition when it enters the human eye. When these secondary light meet the interference conditions, it will form a phenomenon similar to interference and some frequencies of light will be enhanced and some frequencies of light will be suppressed, thus forming a band of colorful light, which is also known as thin film interference or rainbow phenomenon. This phenomenon is not explained by the light is a particle, can not say that different photons will strengthen each other or cancel each other out. Light is also badly explained by electromagnetic waves, because electrons and atomic nuclei are not possible to reflect the electric or magnetic field. Only a thin film and a small water droplet as a secondary light source and produce secondary light to explain the most reasonable.

This phenomenon is ample proof that reflected and scattered light is part of the secondary light produced by the medium.

In summary, the so-called reflected light, scattered light, refracted light, transmitted light, diffracted light, interfered light, bypassed light and converted light that appear when the medium interacts with light are all part of the secondary light produced by the medium after it has been polarized by the incident light into a secondary light source. The existence of half-wave loss of reflected light, Faraday magneto-optical effect of polarized refracted light, single-slit diffraction and double-slit interference phenomena, Seeman effect, ubiquitous light conversion light phenomena, light speed variation law inside the medium and at the intersection surface of different media, graphene surface property change leading to the phenomenon of huge change in absorbance, thin-film interference and rainbow phenomenon form a complete chain of evidence, which together prove that light and medium The law of interaction is that the incident light makes the medium a secondary source and produces secondary light with different transmission direction, speed, amplitude, phase, frequency and wavelength. The so-called reflection, scattering, refraction, transmission, diffraction, interference, bypassing and conversion of light are only part of the secondary light produced by the medium.

chapter two

Determinants and real physical meaning of

the results of several important physics experiments related to light

First,Analysis of the determinants and physical

implications of the results of the Michelson-Morley experiment

1. Introduction to the results of the Michelson-Morley experiment

In 1887, Albert Michelson and Edward Morley conducted the very famous Michelson-Morley experiment at the Cass School of Applied Science in Cleveland. The purpose was to measure the speed of the Earth in the Ether (i.e., the speed of the Ether wind). However, the results of the experiment proved that the speed of the etheric wind was zero or that there was no etheric wind at all. In order to explain that the results of this experiment were completely inconsistent with what people expected before the experiment, between 1887 and 1905, many famous scientists put forward various explanations. The most famous was the Dutch physicist Hendrik Roloz, who proposed the Roloz transformation, later named after him, based on the mechanism of contraction and clock slowing of objects moving relative to the Ether. However, Albert Einstein, a then unknown junior clerk at the Swiss Patent Office, pointed out in a famous paper published in 1905 that the idea of the Ether was superfluous if one was willing to abandon the idea of absolute time. But one must accept the assumption that the speed of light is constant, which is contrary to the well-known common sense. This experiment naturally became an important background and theoretical basis for Einstein's theory of relativity。

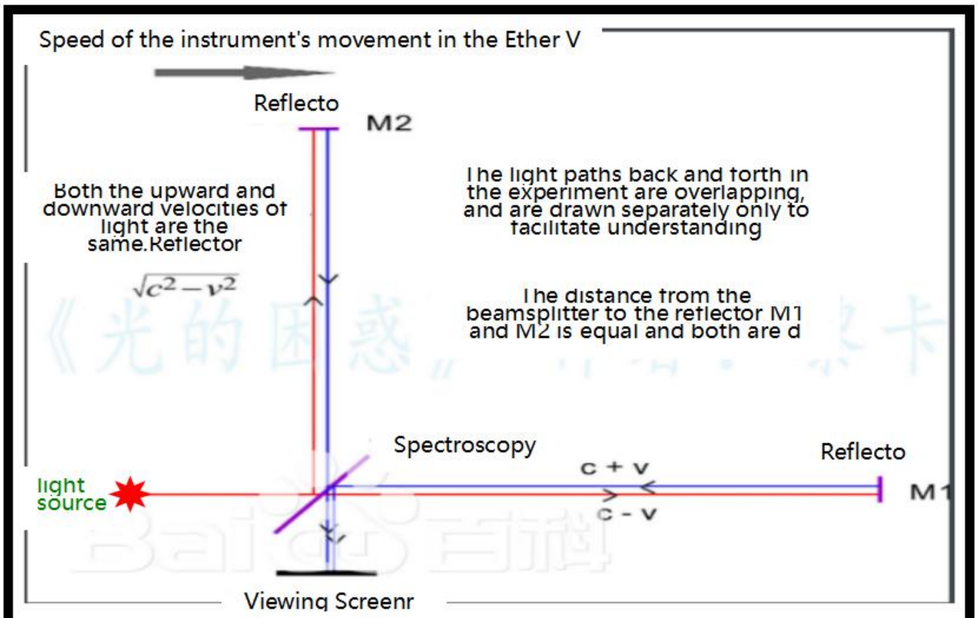


Figure 9: Schematic diagram of the Michelson-Morley experimental setup in the Ether

2. Analysis of possible reasons for determining the results of the Michelson-Morley experiment

2.1, the speed of light in the atmosphere is only constant relative to the speed of the atmosphere is the fundamental reason for determining the results of the experiment

The transmission of light within the atmosphere is the motion and refraction of light waves inside the medium, just as light moves in water and glass, and its velocity is determined by the nature of the medium. In a homogeneous medium, the speed of light motion is also only constant and isotropic with respect to the medium. Therefore, the experiment is carried out in the surface atmosphere in the process, without taking into account the atmospheric anisotropy, the speed of light of any light source used in the experiment is constant and isotropic relative to the atmospheric velocity. When the experimental setup is essentially stationary with respect to the atmosphere (wind speed less than nine), the speed of light used in the experiment is also essentially constant and isotropic with respect to the experimental setup. Therefore, it is perfectly reasonable and normal that no interference fringe movement is found in the experimental results, and it is inevitable。

2.2, the law of action of light and media determines the interferometer in a homogeneous medium or vacuum are unlikely to appear interference fringe changes

Light is produced by a charged body, which is essentially a changing electromagnetic field produced by negatively charged electrons and positively charged protons and their combinations in different modes and states of motion. Similarly, when light encounters a medium composed of electrons and protons, it is subjected to the action of the medium and changes its direction of motion, speed of motion, frequency and amplitude. This is often referred to as the reflection/scattering, refraction/transmission and conversion/thermal radiation of light in optics. In other words: when light encounters a medium, it will make the medium become a secondary source of light with some association with the incident light and produce a new secondary light, and the incident light will be changed or disappeared. The interaction between light and the medium produces the refraction and transmission of light speed change law can be seen in the following Figure X: Figure ab section for the incident light, its speed can be greater or less than the speed of light in the vacuum; into the trigonal prism after the bm section is refracted light, the speed of the trigonal prism by the nature of the material and the state of motion to determine. When the prism is stationary with respect to the experimental device, it is determined by the material properties of the prism and has nothing to do with the speed of the incident light. The speed is the ratio of the speed of light in the vacuum to the refractive index of the material: C/n! mn section from the trigonal prism out of the transmitted light, the trigonal prism is equivalent to a light source, the speed of transmitted light from the trigonal prism out into the vacuum is only constant relative to the speed of the trigonal prism, that is, the speed of light in the vacuum C.

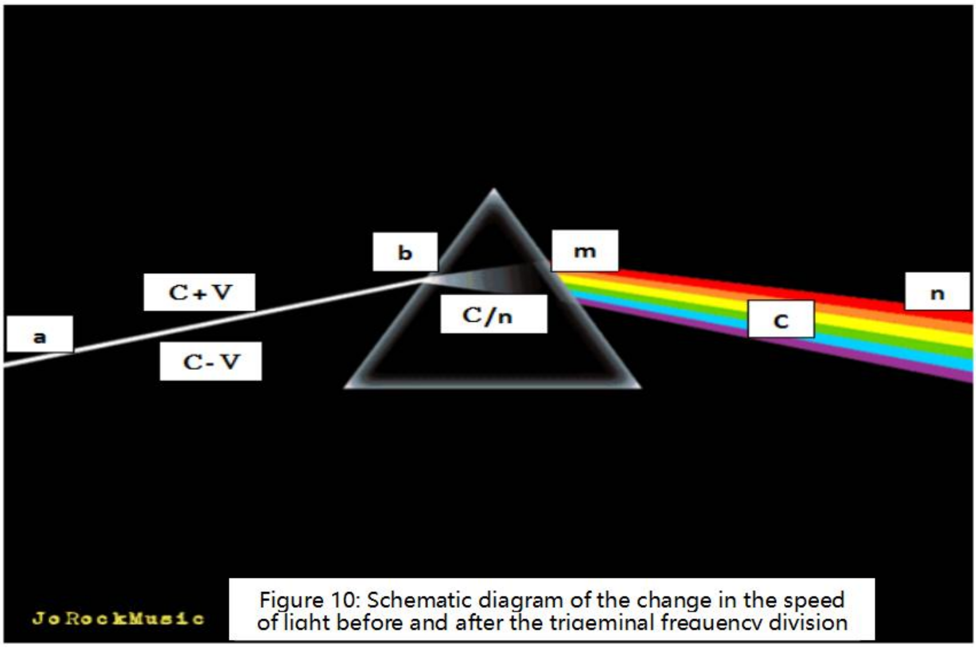


Figure 10: Schematic diagram of the change in the speed of light before and after the trigeminal frequency division

It can be seen that when the experiment is carried out in a uniform medium, the experimental process of light are refracted light inside the medium, the speed of its movement is determined only by the nature of the medium, when the experimental device is stationary relative to the medium or the speed of movement is much smaller than the speed of light in the medium, then the experimental results will certainly not appear interference fringe changes; when the experiment is carried out in a vacuum, the light entering the experimental device will be the experimental device in the trigonometry, semi-lens and reflecting mirror set will be modified. That is, the light used in the experiment is essentially the light transmitted by the trigonal prism after frequency separation, divided into half reflection and half transmission light by the half lens, and then reflected back to the half lens by the reflector, again divided into half reflection and half transmission by the half lens and reach the eyepiece (observation screen). Throughout the experiment, the light is reflected or transmitted by the mirror in the experimental setup, the speed of light is only constant relative to the speed of the mirror. Because the mirror group is the new light source, when the mirror group is stationary relative to the experimental device, the speed of light during the experiment is of course constant relative to the speed of the experimental device. That is: as shown in Figure IX: no matter what the speed of the light produced by the light source when it reaches the beamsplitter, the speed of the reflected and transmitted light through the beamsplitter is only constant relative to the speed of the beamsplitter. When the experimental device is located in the atmosphere and is essentially stationary relative to the atmosphere, the speed of light entering the atmosphere after reflection and transmission by the beamsplitter is constant relative to the atmosphere (and also relative to the experimental device). The same is true for the reflected light after reflection by mirrors M1 and M2. Therefore, regardless of whether the experimental device is in a vacuum or in the atmosphere but is basically stationary with respect to the atmosphere, the speed of the reflected and transmitted light after the beamsplitter and the light reflected by the reflector in the experiment is constant with respect to the speed of the experimental device. This determines that the results of this experiment will not be possible to move the interference fringe.

In summary, it is impossible to detect the anisotropy of the speed of light or the difference in the speed of light at different incidence, either in a homogeneous medium or in a vacuum, using the interferometer method.

Second, the determinants of the photoelectric effect analysis and physical meaning

1、Introduction of photoelectric effect

Photoelectric effect refers to the phenomenon that when light with a frequency higher than a certain value is irradiated to the surface of a metal, the electrons in the metal will escape from the metal surface and become free electrons (referred to as photoelectrons). Through a large number of experiments concluded that the photoelectric effect has the following experimental laws.

1.1. Every metal in the photoelectric effect there is a cut-off frequency (or red limit), that is, the frequency of the irradiated light can not be lower than a critical value. When the frequency of the incident light is lower than the limit frequency, no matter how strong the light can not make the electrons escape.

1.2. The speed of photoelectrons produced in the photoelectric effect is related to the frequency of light, but not to its intensity。

1.3. The transient nature of the photoelectric effect. Experimentally, it was found that the photocurrent is generated almost immediately when shining on the metal. The response time does not exceed ten negative nine seconds (1ns).

1.4. The intensity of the incident light affects only the strength of the photocurrent, i.e., only the number of photoelectrons escaping per unit area per unit time.

2, optical quantum explanation of the defects of the photoelectric effect

2.1, the red limit is only related to the nature of the material and the intensity of the irradiated light independent of the difficulty of breaking the particle interaction law

When the frequency of the light irradiated to the metal surface is higher than the red limit of the irradiated metal material, the photoelectric effect will occur regardless of the intensity of the irradiated light. But if the photoelectric effect is caused by the kinetic energy/momentum carried by the light quanta to increase the kinetic energy/momentum of the electrons in the metal to reach the speed of motion to escape from the metal and become photoelectrons, then we cannot exclude that two or more light quanta slightly below the red limit act on the same electron simultaneously or successively to increase its kinetic energy and momentum and become photoelectrons! Because, according to the interaction between particles, when the particle density increases to a certain procedure, the chance of the same electron being acted on by two or more light quanta simultaneously or successively will increase. Therefore, when the intensity of the irradiated light is increasing, the red limit should gradually decrease.When the frequency of the light irradiated to the metal surface is higher than the red limit of the irradiated metal material, the photoelectric effect will occur regardless of the intensity of the irradiated light. But if the photoelectric effect is caused by the kinetic energy/momentum carried by the light quanta to increase the kinetic energy/momentum of the electrons in the metal to reach the speed of motion to escape from the metal and become photoelectrons, then we cannot exclude that two or more light quanta slightly below the red limit act on the same electron simultaneously or successively to increase its kinetic energy and momentum and become photoelectrons! Because, according to the interaction between particles, when the particle density increases to a certain procedure, the chance of the same electron being acted on by two or more light quanta simultaneously or successively will increase. Therefore, when the intensity of the irradiated light is increasing, the red limit should gradually decrease.

2.2. The angle between the direction of motion of photoelectrons and the direction of light irradiation can be greater than 90 degrees Difficulties in breaking the law of conservation of energy and momentum

As shown in Figure XI below, a large number of experiments have proved that the photoelectric effect in which the angle between the direction of motion of photoelectrons and the direction of light irradiation can be greater than 90 degrees. According to the law of interaction between particles, must follow the law of conservation of momentum and kinetic energy. However, from Figure 1, it can be seen that the angle between the direction of motion of photoelectrons and the direction of light irradiation can be greater than 90 degrees, if the photoelectric effect is caused by the transfer of light quantum momentum and kinetic energy to electrons and the kinetic energy and momentum of electrons increase before becoming photoelectrons, then the law of conservation of kinetic energy/momentum will be broken!

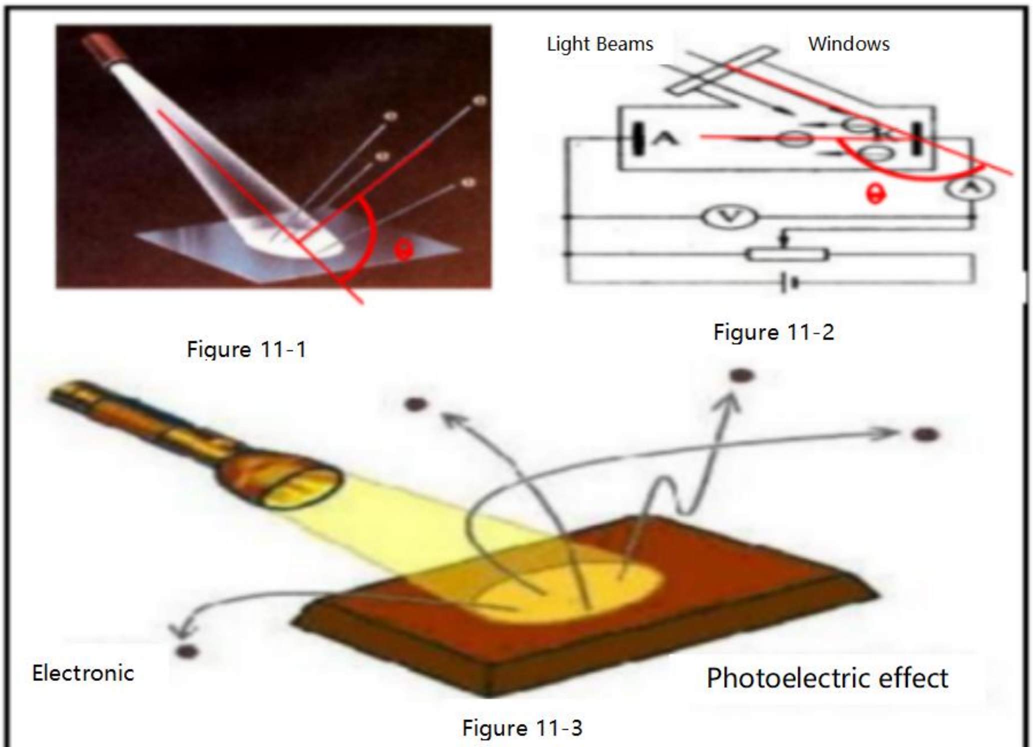


Figure 11: Photoelectric effect experimental setup and the relationship between the direction of photoelectron motion and the direction of irradiated light schematic diagram

2.3, when the irradiation light frequency is high to a certain extent, the number of photoelectrons not only does not increase with the irradiation light frequency but also decreases the phenomenon of the difficulty of violating the law of inter-particle interaction

Figure 12 below shows the spectral characteristics of a photovoltaic cell, which is a graph of the relationship between frequency and the number of internal photoelectrons during the internal photoelectric effect of a semiconductor. Although it is not the usual sense of the external photoelectric effect, the principle and the intrinsic factors should be the same. The frequency characteristics of the general photoelectric effect tube are also basically similar to the normal-like distribution curve with low at both ends and high in the middle shown in Figure II below.

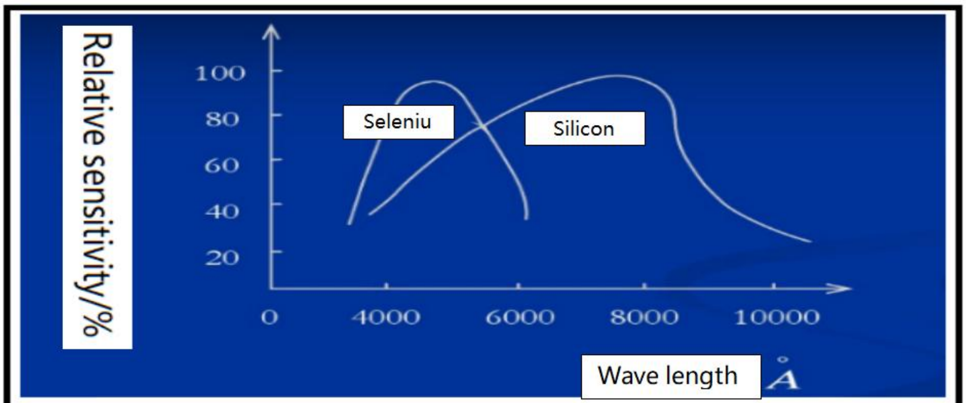


Figure 12: Schematic diagram of the spectral properties of photovoltaic

According to the law of interparticle interaction, if both kinetic energy and momentum of light quanta increase with frequency, then with the same number or density of light quanta, higher frequency light quanta should be able to produce more photoelectrons and not the other way around. In other words, the fact that the number of photoelectrons does not increase with the frequency of the irradiated light is an insurmountable obstacle to the photoelectric effect explained by light quanta, and an important evidence to reject the light quantum theory.

In summary, it is not feasible to explain the photoelectric effect in terms of light quanta carrying momentum/kinetic energy proportional to their frequency!

3, photoelectric effect nature factors to explore

3.1, irradiation of light formed by the alternating electromagnetic field synchronous acceleration of electrons in the atom is the main cause of the photoelectric effect

3.1.1. The laws of external electron motion of the atoms that form the basis of matter are the internal cause

According to the current knowledge of the atomic structure and its mode of existence and laws of motion, it is known that the electrons outside the atom of a general metallic element are in motion around the nucleus at different energy levels, at different speeds, frequencies and distances at high speed. Therefore, to accelerate or decelerate these electrons, an alternating electromagnetic field of a certain phase and frequency has to be applied like an electric motor.

3.1.2. The alternating electromagnetic field generated by irradiated light near the metal surface is the external cause

Light is a changing electromagnetic field, and when light strikes a metal surface, an alternating electromagnetic field of the same frequency as the light will be formed on the metal surface attachment. Therefore, when the frequency and phase of this alternating electromagnetic field meet the synchronous acceleration of some electrons in the metal, then the electrons will be synchronously accelerated. When accelerated to the speed of the electron can escape from the nucleus bondage, then will be free from the metal bondage and become free electrons, that is, photoelectrons. This gives rise to the photoelectric effect。

3.2, molecular thermal motion velocity distribution is one of the important factors to determine the frequency response range of the photoelectric effect

According to Maxwell's velocity distribution law and the blackbody radiation intensity distribution law, it is known that as long as the temperature of the object is not absolute 0 degrees, the molecules are in different states of thermal motion. As shown in Figure XIII below, there is a relationship between the speed of thermal motion of the molecules/atoms inside the metal and the number of molecules/atoms with the same speed in a similar normal distribution when the temperature of the metal plate is constant. Therefore, the overall velocity of the external electron motion of the atoms in the metal (relative to the changing electromagnetic field generated by the irradiated light) is the superposition of the velocity of the thermal motion of the molecules/atoms and the velocity of the electron motion around the nucleus. When light of a certain frequency is irradiated to the surface of a metal, the number of electrons that conform to the simultaneous acceleration also shows a distribution law similar to that of the molecular/atomic thermal motion velocity distribution. Although the velocities of electrons moving around the nucleus are generally discrete and discontinuous, the molecular thermal motion velocities are continuously distributed, making the overall velocity distribution of electrons relative to the changing electromagnetic field generated by the irradiated light continuous. This is the reason why irradiated light above a certain frequency can generally produce the photoelectric effect。

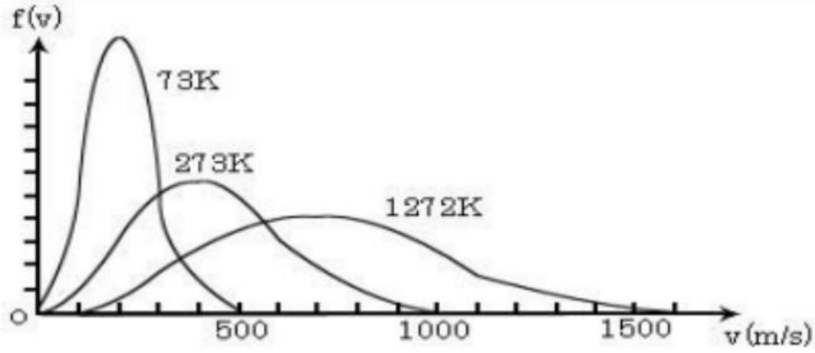


Figure 13: Maxwell's rate distribution curves at different temperatures

3.3, using electromagnetic field synchronous acceleration to explain the photoelectric effect can easily solve the three major obstacles encountered in the quantum interpretation of light

3.3.1, the red limit is only related to the nature of the material and light intensity independent of the problem

At a given temperature, the superimposed acceleration distribution of the velocity of motion of electrons outside the atoms of different materials with respect to the velocity of molecular thermal motion is only related to the type of atoms in the material. Therefore, the minimum frequency of motion around the nucleus and the escape velocity are also only related to the type of atom in the material. This determines that the red limit is only related to the material properties and is largely independent of the light intensity.

3.3.2. The angle between the direction of photoelectron motion and the direction of light irradiation can be greater than 90 degrees

Since the changing electromagnetic field produced by the irradiated light on the metal surface is perpendicular to the direction of light motion. Therefore, the direction in which the electrons are accelerated is also perpendicular to the direction of light motion. Also, due to the superposition of the molecular thermal motion velocity, the position where the electrons are accelerated to the escape velocity can be any position in the accelerated interval. This leads to the fact that the angle between the direction of photoelectron motion and the direction of light irradiation can be any value, so the existence of an angle greater than 90 degrees is also completely normal.

3.3.3, the problem that the number of photoelectrons does not increase continuously with the rise in the frequency of irradiated light

Since the speed of movement of electrons in the atoms inside the metal plate and the frequency of movement around the nucleus show a similar normal distribution between the number of atoms. Therefore, irradiated light above a certain frequency makes it increasingly difficult for electrons to form simultaneous accelerations, and naturally the number of photoelectrons produced decreases. Only irradiated light with a frequency similar to the frequency of electron motion around the nucleus can produce the maximum number of photoelectrons. This explains why the number of photoelectrons does not increase as the frequency of irradiated light increases.

4. An attempt to explain the four experimental laws of the photoelectric effect by simultaneous acceleration of electromagnetic fields

4.1. Each metal in the photoelectric effect there is a red limit related only to the material properties and not to the intensity of light

As mentioned above, the frequency of the external electron motion around the nucleus of each metal is generally related to the energy level of the electron, and the outermost electron moves around the nucleus at a small speed, with a long period or low frequency, and with the least nuclear binding force, and is also the easiest to be the first photoelectronized. However, there is a minimum value for the frequency of electrons around the nucleus in each metal, and the electrons at the minimum frequency have the smallest electromagnetic field acceleration frequency, which is the red-limit frequency. Therefore, the red limit of each metal is, of course, only related to the material properties and not to the light intensity. See also the description in paragraph 3.1 of the previous section.

4.2 .The speed of photoelectrons produced in the photoelectric effect is related to the frequency of light, but not to the intensity of light

The speed of photoelectrons generated in the photoelectric effect is related to the escape speed of electrons from the metal bondage. In general, there are electrons of different energy levels in metallic materials. The electrons of different energy levels are bound by different atomic forces and have different escape velocities. And the electrons with different escape velocities require different electromagnetic field frequencies for simultaneous acceleration. That is, the inner electrons in the metal are more constrained than the outer electrons, moving around the nucleus at a higher speed, moving around the nucleus at a higher frequency, more difficult to escape from the metal, the higher the EMF frequency needed to achieve synchronous acceleration, and once they become photoelectrons, their movement speed is naturally higher. Therefore, when the irradiation frequency is increased, it can make the electrons in the metal with stronger binding force and higher motion speed also become photoelectrons. The speed of these electrons after becoming photoelectrons will of course be higher than the speed of photoelectrons produced by light of lower frequency. The higher the frequency, the higher the speed of the photoelectrons. Since the ability to produce photoelectrons is only related to the frequency of the light that forms the synchronous acceleration, it is not related to the intensity. Therefore, the change in the speed of photoelectrons is also independent of the intensity of light.

4.3. The instantaneous nature of the photoelectric effect, with a response time of no more than ten negative nine seconds (1ns)

Generally, the red limit of the photoelectric effect of metals in the visible wavelength band or higher frequency band, the general frequency are higher than 4.2 * 1014Hz, that is, the period is less than 2.38 * 10-15S. Therefore, the photoelectric effect response time of 1ns, then in this time period, the number of periods of light above the red limit in more than 420000 weeks. The number of periods of electron synchronous acceleration required for the photoelectric effect is more than enough. In fact, after a certain number of periods of synchronous acceleration, due to the increasing speed of electron motion, the synchronous acceleration conditions will be gradually destroyed, and the electrons have gained high enough speed to break away from the nucleus constraints and fly out of the metal to become photoelectrons. Although the process from light irradiation to the metal surface to electron escape from the metal is only within 1ns, the actual acceleration process does not take that long to complete. Of course, compared to the period of light, the photoelectric effect response time cannot even be called instantaneous anymore!

4.4. The number of photoelectrons is positively correlated with the intensity of the incident light. That is, the stronger the incident light is at a constant light frequency, the more the number of photoelectrons produced in a certain time

As the intensity of light increases, the intensity of the changing electromagnetic field produced by light near the metal surface increases, and the thickness range of the affected metal increases. As a result, the number of affected atoms also increases, and the number of electrons eligible for simultaneous acceleration also increases. On the other hand, due to the increase in the electromagnetic field strength, the time required for the electrons to be synchronously accelerated to the escape velocity is also reduced. Some electrons that cannot be accelerated to escape velocity can be accelerated to escape velocity and become photoelectrons. This leads to the phenomenon that the number of photoelectrons increases with the intensity of light.

In summary, the explanation of the photoelectric effect by Einstein's light quanta is seriously flawed and deficient. In contrast, explaining the photoelectric effect by electromagnetic field synchrotron acceleration does not have any defects and obstacles, and can almost be called perfect and complete. At the same time, this explanation method also avoids unnecessary light quantum assumptions, but starts from the objective reality of the atom itself, which is more in line with the objective reality.

Third, Analysis of the determinants and physical meaning of the Compton effect

1. Introduction to the Compton effec

The Compton effect refers to the scattering of X-rays by free electrons when the scattered X-rays are divided into two parts, one part is the same wavelength as the original incident ray, while the other part is longer than the original ray wavelength, and there is a functional relationship between the specific size and the scattering angle.

2. Analysis of the mechanism of Compton effect

According to the law of light-medium interaction, the incident X-rays cause the electrons and nuclei of the atoms in the metal to change their state of motion and produce secondary X-rays. When the incident X-rays have a different ability to change the motion of electrons and nuclei at different apparent velocities and are dependent on the apparent angle, the frequency of secondary X-rays produced by atoms in different apparent directions will be different, i.e. the frequency of secondary X-rays produced by atoms at different apparent velocities will be different from that of the incident X-rays and will vary with the scattering angle, just like the so-called red-shift mechanism.

3. The physical meaning of the Compton effect

The Compton effect further proves that the law of light-medium interaction is that the incident light causes the atoms in the medium to be polarized into secondary sources and produces the corresponding secondary light, and does not reflect or scatter the so-called incident light.

Fourth,The mechanism and physical meaning of the observation result that the redshift of starlight is proportional to the distance.

1. Hubble constant and the relationship with observation frequency

1.1, Hubble constant

According to the relevant data: Hubble's initial measurement of the Hubble constant is 500 km/s/Mpc; the Hubble constant calculated by using the Hubble telescope to observe the parent variable and the standard cosmic candle method to calculate the distance of galaxies, given the redshift of the combined galaxies is 74 Km/s/Mpc; the Hubble constant obtained by using the cosmic background radiation observation data and the standard model of the universe method is 67.8 Km/s/Mpc. And the Hubble constant obtained by replacing the standard candle-making parent variable with a red giant is 69.8 Km/s/Mpc.

1.2 Hubble constant versus observation frequency

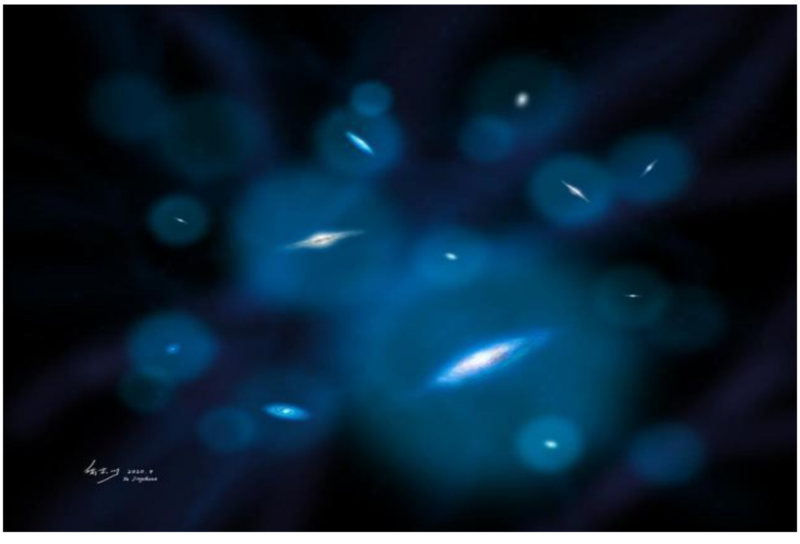
From the analysis of the frequency band of the received starlight used by the three measurement methods and the measured data obtained, it is clear that the value of the Hubble constant increases with the frequency used. This law may indicate that the redshift of the object is the result of the action of the interstellar matter: the higher the frequency of the starlight, the greater the rate of frequency reduction in the interstellar matter.

2. Analysis of the real reason why the amount of starlight redshift is proportional to the distance

2.1. There is a certain density of cryogenic matter in interstellar space

According to recent astronomical observations: the interstellar space is not an ideal vacuum with nothing in it. Rather, there is a certain density of cryogenic material. For example, according to NASA's public information, the Hubble telescope's latest discovery, Andromeda has hit our Milky Way galaxy. In fact it is Andromeda and the Milky Way are basically occupied by gaseous matter between them.

Another article published by the China Science and Technology Museum on September 03, 2020, entitled "Eight "magnifying glasses" to take a picture of the dark matter halo", describes the situation of taking pictures of dark matter and posts the relevant photos as follows.



2.2. Analysis of the real reason why the amount of starlight redshift is proportional to the distance

According to the law of light-medium interaction: the starlight observed by earthlings (including telescopes in space) is secondary refracted light produced by interstellar matter, not primary light produced by celestial bodies. Therefore, it is entirely possible that the frequency of the secondary light is slightly lower than that of the incident light, and it is perfectly normal that this leads to a gradual decrease in the frequency of the starlight during the transfer/regeneration of the interstellar matter from stick to stick. When the distribution of interstellar matter is essentially homogeneous and isotropic on a macroscopic scale, it follows that the redshift of starlight is proportional to the distance.

3, the physical meaning of the amount of starlight redshift is proportional to the distance

The phenomenon that the redshift of starlight is proportional to distance proves that starlight is not primary light, but secondary light produced by interstellar matter. This is the fundamental reason for the existence of multiple clusters of emission and absorption lines with different redshifts in the spectra of distant quasars. In principle, quasars should have only one set of redshifts. Since quasars have only one apparent velocity with respect to the Earth, if the redshift is a Doppler effect, there can only be one set of redshifts. It is because of the existence of interstellar matter with different apparent velocities that the frequency of the secondary light of the quasar they are regenerating should be different from the primary light of the quasar.

In conclusion, the light-medium interaction law summarized in this paper can easily explain almost all the current light-related material phenomena and experimental results. This also proves from one side that the light-medium interaction law summarized in this paper should be consistent with the objective facts and is correct.

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Due to my lack of English ability, the Chinese to English translation was achieved through common software. Therefore, the English version is likely to have more inaccurate and not easily understood parts. In order to facilitate the review of the manuscript by experts, the original Chinese version is attached. Please accept my apologies for any inconvenience.

光与介质相互作用规律证明光既不是电磁波也不是光子更没有波粒二相性

作者：彭晓韬

日期：**2023.03.22**

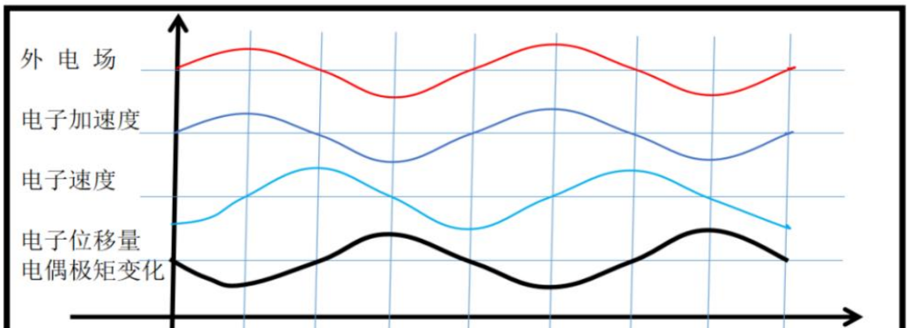
[文章摘要]：光与介质相作用后会改变光的所有特征，包括但不限于光的传递方向、光的相位、光的振幅、光的频率、光的波长、光的速度等。但人们对光到底是什么的认识至今仍未能完全统一，有认为光是电磁波的，也有认为光是光子的，更有认为光具有波粒二相性的。通过本人长时间的研究发现：从反射光存在的半波损失、偏振折射光存在的法拉第磁光效应、单缝衍射光强度变化四规律、双缝干涉现象、塞曼效应、介质表面状态决定吸光率的现象、光速在不同介质界面处跃变及均匀介质内部光速相对介质本身速度恒定等现象综合分析后可得出：光既不是电磁波，也不是光子，更没有波粒二相性。光应该只是电荷之间才存在的库仑力和磁力相互作用的表现形式之一，并不能是可以脱离电荷/光源而独立存在的客体。本文重点以光与介质相互作用规律的诸多证据所形成的证据链来探讨相关问题，以期纠正目前人们对光的本质的错误认识。同时，用光与介质相互作用规律解释几个与光有关的物理实验结果，如：迈克尔逊-莫雷实验、光电效应和康普顿效应。

第一章

完整证据链充分证明光与介质相互作用规律是入射光使介质成为次生光源

一、反射光存在的半波损失产生机理及证据效力

当入射光为正弦波，即电场强度（库仑力的归一化）为 E=Asin2πft 时，其对介质中原子中的电子与原子核施加的库仑力的方向正好相反，因此，其施加到电子和原子核上的加速度方向也是相反，也就是原子会被极化为电偶极子。该电偶极子的偶极矩正好与入射光的相位滞后半个周期：因为电子和原子核的加速度与入射光相位相同；电子和原子核的速度则落后入射光 1/4 同期，即△V∽-Acos2πft；电子和原子核的位移量落后入射光半个周期，即△s∽-Asin2πft。而被极化的原子电偶极子产生的次生光的相位与电偶极子的偶极矩同步。因此，次生光与入射光相位差半个周期。这才是所谓的反射光存在半波损失的机理。如下图一所示：



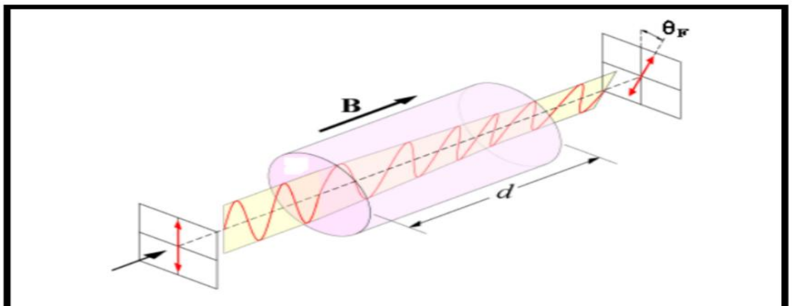
图一：原子中的电子在外电场作用下的运动状态及电偶极矩变化示意图

半波损失机理直接证明：反射光是介质被入射光极化为次生光源后产生的次生光的一部分。

二、偏振折射光存在的法拉第磁光效应产生机理及证据效力

由ψ=VBd可知：法拉第磁光效应与外加磁场强度B和透明介质长度d成正比。也就是说：当外加磁场和/或透明介质均不存在时，就没有该效应了。由此可见，该效应既不是由外加磁场单独完成的，也不是由介质单独完成的，而是两者合作后才完成的。既然磁场不能直接改变光的偏振方向，当然也不可能改变介质内部的折射光的偏振方向；介质也不能在没有外加磁场的配合下改变折射光的偏振方向。剩下的只有一种可能性，即在介质中的原子再生光的过程中，外加磁场使电子和原子核改变了运动方向，致使其产生的次生光的偏振方向随之发生改变，从而次生光与入射光的偏振方向存在些许差异，从而导致了偏振折射光的方向发生改变的。这才是偏振折射光法拉第磁光效应的机理。

这一现象充分证明：折射光是由介质产生的次生光的一部分。



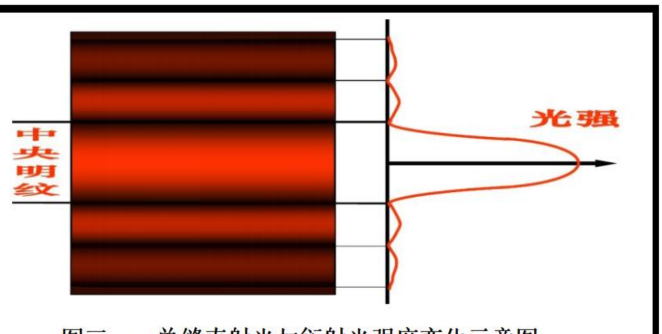
图二：偏振折射光法拉第磁光效应示意图

三、单缝衍射光强度变化规律的决定因素及证据效力

单缝衍射光强度变化有四大规律：一是衍射光存在类似干涉现象的明暗条纹；二是衍射光明暗条纹之间的距离与单缝宽度成反比；三是衍射光强度最大值一般不大于直射光的20%；四是当用超黑材料覆盖单缝边缘或直射光不照射到单缝边缘时，衍射光强度为0。

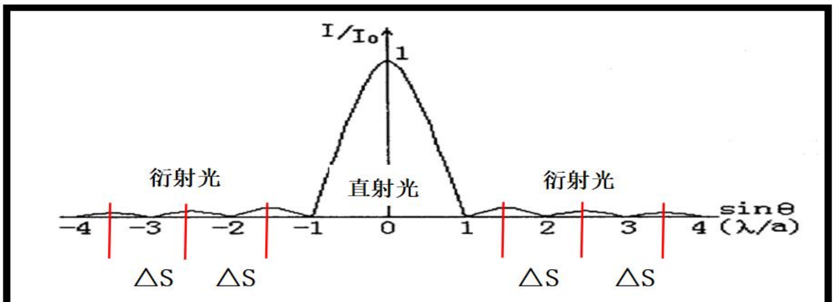
1、衍射光强度呈现类似干涉的明暗条纹

如下图三所示：衍射光的强度变化呈现明显的明暗分区，与双缝干涉图像基本相同。



图三一：单缝直射光与衍射光强度变化示意图

2、衍射光的明暗条纹间距与单缝宽度成反比



图四：单缝衍射光强度变化示意图

当单缝宽度为 b、单缝到屏幕的垂直距离为 H、直射光的波长为λ时，则有：单缝衍射光条纹间距△S 为：

$$\Delta S = \frac{\lambda H}{b} \qquad \text{（公式 1）}$$

由（公式 1）可知：单缝衍射光的明暗条纹间距与直射光的波长、单缝到屏幕的垂直距离成正比，与单缝宽度成反比。

3、直射光强度是衍射光主瓣强度的 5 倍以上

如上图四所示：直射光强度是衍射光主瓣强度的 5 倍以上，而衍射光第 1、2、3 瓣的强度差异则较小，强度差异应该在 20%以内。

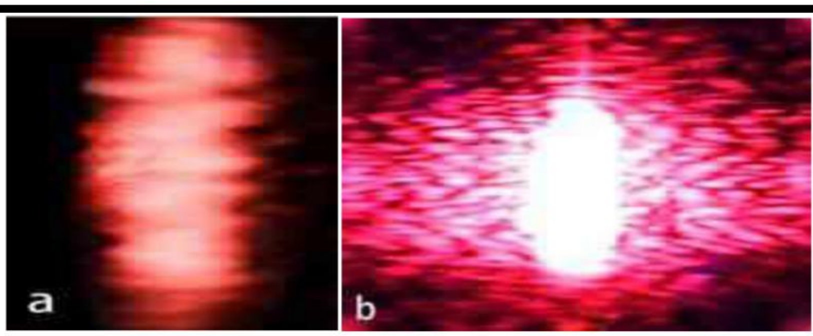
4、直射光不照射到单缝边缘或用超黑材料覆盖单缝边缘时无衍射光

4.1、当光不照射到单缝边缘时无衍射光

季灏先生在《“衍射”、“干涉”现象的新研究》一文中指出：“另外，我们发现单缝一边被激光照射时，会出现直边衍射图像，当另一边逐渐靠近时，激光照射到这一边时一般都会出现较清晰的衍射图像，但条件是必须光源同时照射到两狭缝的边，否则即使狭缝的宽度小到足够产生单缝衍射的几何尺寸时也只出现一边的直边衍射图像，不会出现清晰的衍射图像”。

4.2、用超黑材料覆盖单缝边缘时无衍射光

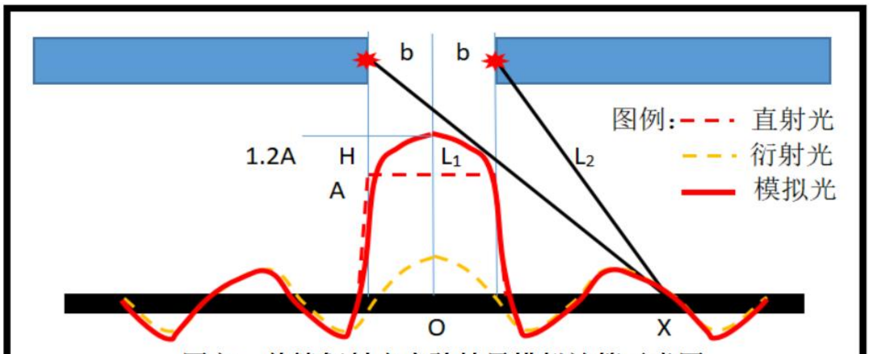
杨发成先生在《光学实验中的新发现》一文中公开了用超黑材料覆盖单缝边缘后就没有衍射光的实验结果，如下图五所示:



(a)演示观察屏上出现的一条明纹，(b)摄像机镜头正对超黑单缝屏所拍之照片

图五:超黑材料覆盖单缝边缘时的光学实验结果照片

由此可见，决定衍射光强度变化规律的因素有二：一是单缝边缘的特性（再生光能力）；二是单缝间距（两个次生相干光源间的距离）。如下图六所示：



图六：单缝衍射光实验结果模拟计算示意图

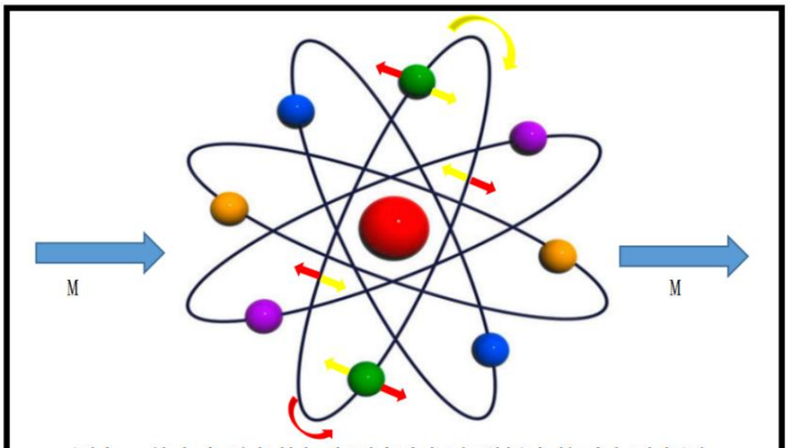
衍射光强度的这些特征充分证明：衍射光就是单缝边缘产生的次生光的一部分。

四、双缝干涉光强度变化规律决定因素及证据效力

双缝干涉光强度变化规律为：存在明暗交替的干涉条纹。实际上，双缝干涉只是二个单缝靠得较近时的情况而已，与单缝衍射光无本质上的区别。因此，所谓的干涉光只是缝边缘产生的次生光的一部分，由二组共四条相互平行的缝隙边缘产生的次生光的矢量叠加结果而已。

五、塞曼效应及证据效力

塞曼效应是指原子在外磁场中发光谱线发生分裂且偏振的现象，也就是外加磁场会使原子产生更多不同频率的特征谱线的偏振光。历史上首先观测到并给予理论解释的是谱线一分为三的现象。



图七：单个电子在外加水平方向恒定磁场中的受力示意图

我们可以将外加恒定磁场视为一种特殊的入射光→无库仑力的恒定的磁力。当对介质施加

该磁力时，介质内部的原子中的电子因绕原子核运动平面法向与外加磁力方向间的夹角（假定为θ）不同而出现三种可能变化：当 0°＜θ<90° 时，电子绕核运动速度会因此而降低，从而导致其产生的电磁辐射频率降低（光谱线红移）；当θ=90° 时，电子绕核运动速度不变（对应未施加外磁场时的光谱线）；当 90°＜θ<180° 时，电子绕核运动速度会因此而提高，从而导致其产生的电磁辐射频率上升（光谱线蓝移）。从而出现在外加恒定磁场下，介质产生的光谱线会出现一分为三的现象。

由此可见，像入射光给介质施加变化的库仑力和磁力一样，当给介质施加一个恒定的磁力时，介质产生的光的特性也会因此而变化。这从一个侧面证明光与介质相互作用的规律是：入射光改变了介质的发光特性而产生不同的次生光。

六、介质表面状态决定吸光率的现象及证据效力

石墨烯的吸光率一般为 2~3%。但通过特殊工艺使其表面产生某种纹理就会成为超级吸光材料，其吸光率可达 90%以上的现象表明：反射和散射光并不是介质表面把入射光反射和散射出来那么简单，否则，当反射界面形状变化时，反射和散射光的总强度不应该发生明显变化，只会因界面形状的不同改变反射和散射光的方向与强度比例。

对介质表面进行某种特殊处理就会大幅度改变介质的吸光率的现象表明：反射和散射光并不是介质表面把入射光反射或散射出来了，而是介质重新产生的光。当表面形状不同时，其产生的次生光的叠加结果自然就会不同。当一半次生光与另一半次生光的相位正好相差半个周期时，其叠加结果就会相互抵销而消失。这才是所谓的介质表面形状不同时，吸光率会出来巨大变化的内因。

不同介质表面性状导致材料吸光率（反射和散射光总强度）巨大变化的现象证明：材料的吸光率并不是材料吸收光的能力，而是其产生的次生光的相位变化导致其反射和散射光总强度发生剧烈变化。

七、无处不在的光的转换现象及证据效力

人们在日常生活中会发现：在同一太阳光照射下，地表上的万物有万种不同的颜色。这是用光是电磁波或光子都不好解释的自然现象。如果光是电磁波或光子，遇到平整度相同的不同介质表面，其产生的反射和散射光应该不出现大的变化，颜色不应千变万化。特别是同由碳原

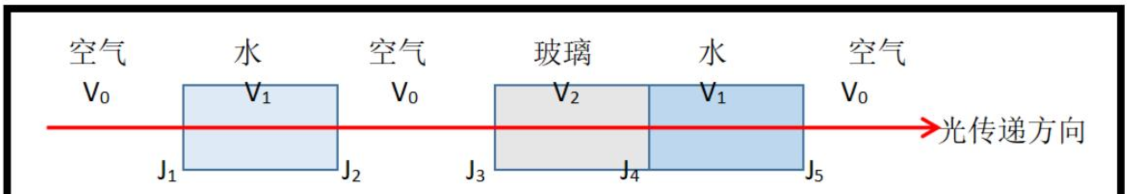
子构成的石墨和金刚石，在其表面平整相同的情况下，在同一光源产生的光照射到其表面时，其反射和散射光应该基本一致才对，但事实上并非如此。石墨是黑色不透明体，而金刚石却是透明体。这是用光是电磁波或光子都难以解释的现象。但用反射和散射光、折射光和透射光都是由介质产生的次生光就很好解释了：由于石墨与金刚石的分子和原子排列方式不同，其每个原子和分子作为次生子光源产生的次生光在空间位置上的矢量叠加结果自然不同。石墨的矢量叠加结果为相互抵消，从而没有多少反射和散射光而为黑色；金刚石的矢量叠加结果为折射光较强从而呈现为透明体。

自然界中各种物质表面颜色千奇百怪的原因就是其表层厚度一定范围的原子和分子在入射光的作用下成为次生光源所产生的次生光的矢量叠加结果的频率与入射光不同导致的。这就是最常见的光的转换现象——反射和散射光的频率与入射光出现巨大变化的现象。

反射和散射光这种频率变化现象充分证明：反射和散射光是由介质产生的次生光的一部分。

八、决定介质中光速的主要因素及证据效力

如下图八所示：假设水中的光速为 V_1=22.5 万千米/秒、玻璃中的光速为 V_2=20 万千米/秒、空气中的光速为 V_0=30 万千米/秒时，则不同介质交界面处的光速变化如下：



图八：不同介质中光速变化示意图

界面 J_1 处光速由 30 万千米/秒降低为 22.5 万千米/秒；界面 J_2 处光速由 22.5 万千米/秒跃升为 30 万千米/秒；界面 J_3 处光速由 30 万千米/秒降低为 20 万千米/秒；界面 J_4 处光速由 20 万千米/秒跃升为 22.5 万千米/秒；界面 J_5 处光速由 22.5 万千米/秒跃升为 30 万千米/秒。而介质内部的光速均相对介质本身速度恒定不变。

以上均匀介质内部的光速是不变的且与入射光速度无关，但在不同介质交接面处光速会发生突变甚至是突升，这是用光是光子难以解释的现象。用光是电磁波来解释的话，也得认定电磁波是由介质产生的或在介质中电磁波的传递速度不同。但用介质内部的折射光为介质产生的次生光就很好解释这一现象了：不同介质中，单位长度内光的再生次数不同，当介质均匀时，单缝长度内的再生次数是相同的，虽然每再生一次需要消耗半个周期的时间，但单位长度内所需消耗的总时间是相同的。所以，均匀介质内部的折射光速是相同的。但不同介质中单位长度内的折射光再生次数不同，所有光速也就不同。

折射光速由介质性质决定充分证明：介质内部的折射光是由介质产生的次生光的一部分。

九、薄膜干涉与彩虹现象机理及证据效力

当太阳光照射到薄膜和由悬浮于空中的小水珠构成的云朵时，薄膜和小水珠就成为了次生光源，不同部位的原子、分子和分子团（可简称为“极化体”）产生的次生光进入人的眼睛时就会遵循矢量叠加原理而形成叠加。当这些次生光满足干涉条件时，就会形成类似干涉现象而出来某些频率的光得到加强，另一些频率的光受到压制，从而形成七彩光带，也就是所谓的薄膜干涉或彩虹现象。这一现象用光是粒子是解释不了的，总不能说不同的光子会相互加强或相互抵消吧。用光是电磁波也不好解释，因为电子和原子核都不可能反射电场或磁场。只能用薄膜和小水珠为次生光源并产生次生光来解释最为合理。

这一现象充分证明：反射和散射光是由介质产生的次生光的一部分。

综上所述，当介质与光相互作用时所出现的所谓的反射光、散射光、折射光、透射光、衍射光、干涉光、绕射光和转换光都是由介质被入射光极化成为次生光源后所产生的次生光的一部分。反射光存在的半波损失、偏振折射光存在的法拉第磁光效应、单缝衍射和双缝干涉现象、塞曼效应、无处不在的光的转换光现象、光在介质内部和不同介质交接面处光速变化规律、石墨烯表面性状变化导致吸光率巨变现象、薄膜干涉和彩虹现象等形成了一个完整的证据链，共同证明光与介质相互作用规律是：入射光使介质成为次生光源并产生传递方向、速度、振幅、相位、频率、波长不同的次生光。所谓的反射、散射、折射、透射、衍射、干涉、绕射和转换光只是介质产生的次生光的一部分而已。

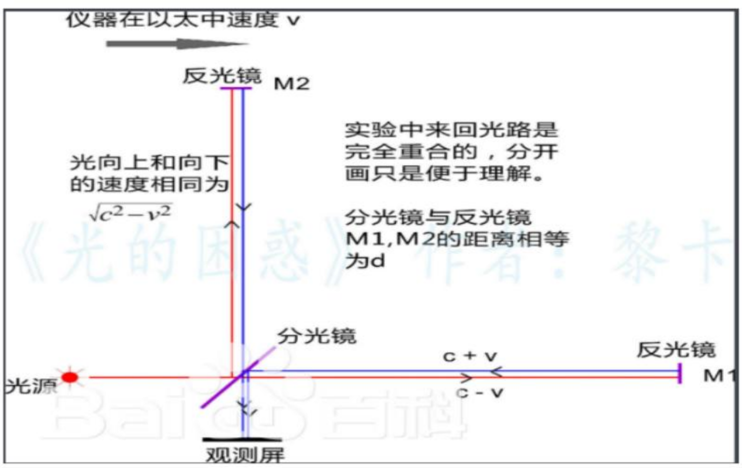
第二章

几个与光有关的重要物理实验结果的决定因素及真实物理含义

一、迈克尔逊-莫雷实验结果的决定因素分析与物理含义

1、迈克尔逊—莫雷实验结果简介

1887 年，阿尔贝特·迈克尔逊和爱德华·莫雷在克里夫兰的卡思应用科学学校进行了非常著名的迈克尔逊-莫雷实验。目的是测量地球在以太中的速度(即以太风的速度)。但事与愿违，实验结果证明以太风的速度为 0 或根本不存在以太风。为解释此项实验结果与人们在实验前的预期完全不一致的问题，在 1887 年到 1905 年之间，许多著名的科学家提出了各种不同的解释。最著名者为荷兰物理学家亨得利克·罗洛兹，他依据相对于以太运动的物体的收缩和钟变慢的机制提出了后来以其名字命名的罗洛兹变换。然而，一位当时还不知名的瑞士专利局的小职员阿尔贝特·爱因斯坦，在 1905 年发表的一篇著名的论文中指出，只要人们愿意抛弃绝对时间观念的话，以太的观念就是多余的。但人们必须接受光速不变这样一个与人们所熟知的常理相违背的假设。这一实验自然就成了爱因斯坦相对论产生的重要背景和理论基础。



图九：以太中的迈克尔逊-莫雷实验装置示意图

2、决定迈克尔逊—莫雷实验结果的可能原因分析

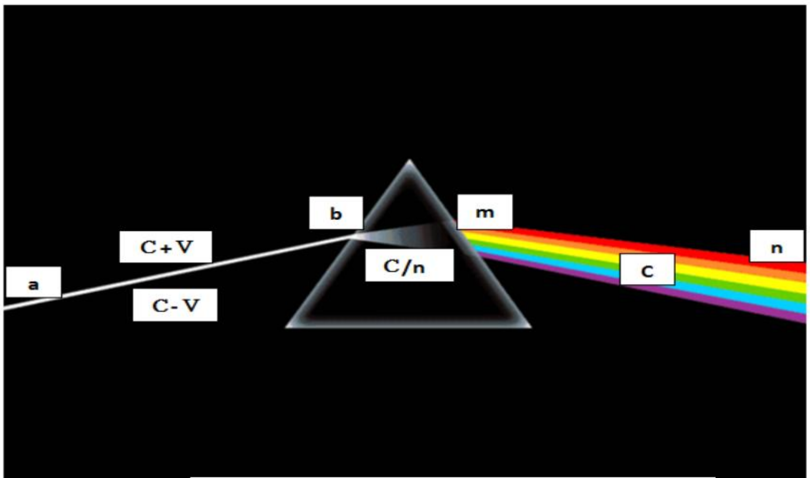
2.1、大气层内光速仅相对大气层速度恒定是决定实验结果的根本原因

光在大气层内传递就是在介质内部运动和折射光波，就像光在水和玻璃中运动一样，其速度由介质的性质决定。在均匀介质中，光的运动速度也仅相对介质恒定且各向同性。因此，本实验在地表大气层内进行的过程中，在不考虑大气层各向非异性的条件下，实验中所使用的任何光源的光速均为相对大气层速度恒定且各向同性。当实验装置相对大气层基本静止（风速小于九级）时，则实验中所使用的光的速度相对实验装置也基本恒定且各向同性。因此，实验结

果未发现干涉条纹移动完全合理和正常，也是必然的。

2.2、光与介质的作用规律决定了干涉仪在均匀介质或真空中均不可能出现干涉条纹变化

光是由带电体产生的，实质上就是带负电荷的电子和带正电荷的质子及其组合物在不同运动方式和状态下产生的变化电磁场。同样地，光遇到由电子和质子组成的介质时，也会受到介质的作用而改变运动方向、运动速度、频率和振幅。也就是光学中常说的光的反射/散射、折射/透射和转换/热辐射。也就是说：当光遇到介质时，会使介质成为与入射光有一定关联的次级光源而产生新的次级光，入射光将被改变或消失。光与介质的相互作用产生的折射与透射光速变化规律可参见下图十：图中 ab 段为入射光，其速度可以是大于或小于真空中的光速；进入三棱镜后的 bm 段则为折射光，其速度由三棱镜的材料性质和运动状态决定。当三棱镜相对实验装置静止时，则由三棱镜的材料性质决定，与入射光的速度无关。其速度为真空中的光速与材料折射率之比：C /n！从三棱镜出来后的 mn 段为透射光，三棱镜相当于一个光源，从三棱镜出来进入真空的透射光的速度仅相对三棱镜速度恒定，即为真空中的光速 C 。



图十：三棱镜分频前后光速变化示意图

由此可见，当实验在均匀介质中进行时，实验过程的光均为介质内部的折射光，其运动速度仅由介质性质决定，当实验装置相对介质静止或运动速度远小于介质中的光速时，则实验结果肯定不会出现干涉条纹变化；当实验在真空中进行时，进入实验装置的光将会被实验装置中的三棱镜、半透镜和反射镜组所改造。也就是实验中使用的光实质上是由三棱镜分频后的透射光，经半透镜分为一半反射、一半透射光，再由反射镜反射回半透镜，再次由半透镜分为一半反射、一半透射而到达目镜（观察屏）。整个实验过程中，光被实验装置中的镜体反射或透射后的光速仅相对镜体速度恒定。因为镜体组就是新的光源，当镜体组相对实验装置静止时，实验过程中的光速当然就相对实验装置速度恒定。即：如图九所示：无论光源产生的光到达分光镜时的速度是多少，通过分光镜后的反射和透射光的速度仅相对分光镜速度恒定。当实验装置位于大气层内并相对大气层基本静止时，则经分光镜反射和透射后进入大气层的光的速度相对大气层

（也相对实验装置）速度恒定。经反射镜 M1 和 M2 反射后的反射光也是如此。因此，无论实验装置是在真空中还是在大气层中但相对大气层基本静止时，其实验中经分光镜后的反射和透射光及经反光镜反射的光的速度均相对实验装置速度恒定。由此决定了本实验结果就不可能出现干涉条纹的移动。

综上所述，无论是在均匀介质中还是在真空中，使用干涉仪法是不可能检测出光速的各向异性，也不可能检测出不同入射光速的差异的。

二、光电效应的决定因素分析与物理含义

1、光电效应简介

光电效应是指当频率高于一定值的光照射到金属表面时，金属中的电子会从金属表面逸出并成为自由电子（简称为光电子）的现象。通过大量的实验总结出光电效应具有如下实验规律：

1.1. 每一种金属在产生光电效应时都存在一截止频率（或称红限），即照射光的频率不能低于某一临界值。当入射光的频率低于极限频率时，无论多强的光都无法使电子逸出。

1.2. 光电效应中产生的光电子的速度与光的频率有关，而与光强无关。

1.3. 光电效应的瞬时性。实验发现，即几乎在照到金属时立即产生光电流。响应时间不超过十的负九次方秒（1ns）。

1.4. 入射光的强度只影响光电流的强弱，即只影响单位时间单位面积内逸出的光电子数目。

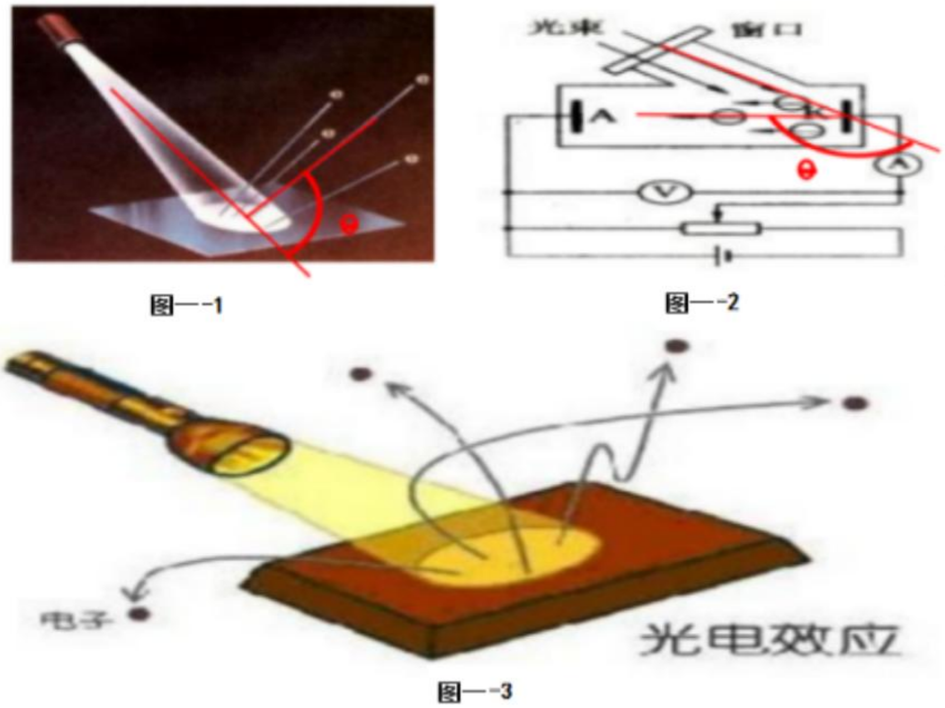
2、光量子解释光电效应存在的缺陷

2.1、红限仅与材料性质有关而与照射光强度无关破坏粒子相互作用规律的困难

当照射到金属表面的光的频率高于被照射金属材料的红限时，无论照射光的强度如何，均会产生光电效应。但如果光电效应是由光量子携带的动能/动量使金属中电子的动能/动量增加而达到逃逸出金属的运动速度而成为光电子的话，则我们不能排除稍低于红限的两个或两个以上的光量子同时或先后作用于同一电子而使其动能和动量增加而成为光电子！因为，按照粒子间的相互作用，当粒子密度提高到一定程序后，则同一个电子被两个或两个以上光量子同时或先后作用的机会将不断增加。因此，当照射光的强度不断增加时，则红限应该逐渐降低才对。

2.2、光电子运动方向与光照射方向间的夹角可大于 90 度破坏能量与动量守恒定律的困难

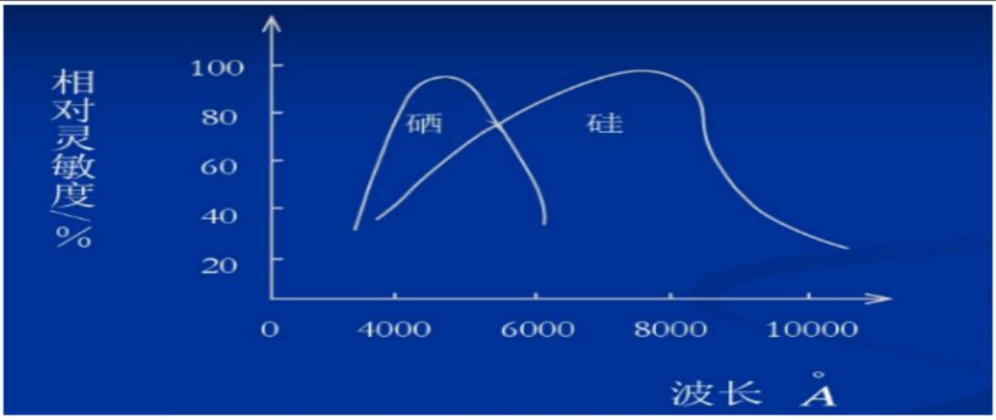
如下图十一示，大量实验证明：光电效应中，光电子的运动方向与光的照射方向间的夹角可以大于 90 度。按照粒子间的相互作用规律，必须遵循动量和动能守恒定律。但从图一可知：光电子的运动方向与光的照射方向间的夹角可大于 90 度时，若光电效应是由光量子动量和动能转移到电子上而使电子的动能和动量增加才成为光电子的话，则将破坏动能/动量守恒定律！



图十一：光电效应实验装置及光电子运动方向与照射光方向关系示意图

2.3、当照射光频率高到一定程度后，光电子数量不但不随照射光频率升高而增加反而减少的现象违背粒子间相互作用规律的困难

下图十二为光电池的光谱特性，也就是半导体内光电效应时的频率与内光电子数量间的关系图。虽然不是通常意义的外光电效应，但其原理和内在因素应该是相同的。一般光电效应管的频率特性也基本类似于下图二所示的两端低、中间高的类正态分布曲线。



图十二：光电池的光谱特性示意图

按照粒子间的相互作用规律，如果光量子的动能和动量均随频率升高而增加的话，则在同样光量子数量或密度的情况下，频率越高的光量子应该可以产生更多的光电子而不是相反。也就是说：光电子数量不随照射光频率的升高而增加的事实是光量子解释光电效应无法逾越的障碍，也是否定光量子说的重要证据。

综上所述，用携带与其频率成正比的动量/动能的光量子解释光电效应是不可行的！

3、光电效应本质因素探讨

3.1、照射光形成的交变电磁场同步加速原子中的电子是产生光电效应的主因

3.1.1、构成物质的基础原子的外部电子运动规律是内因

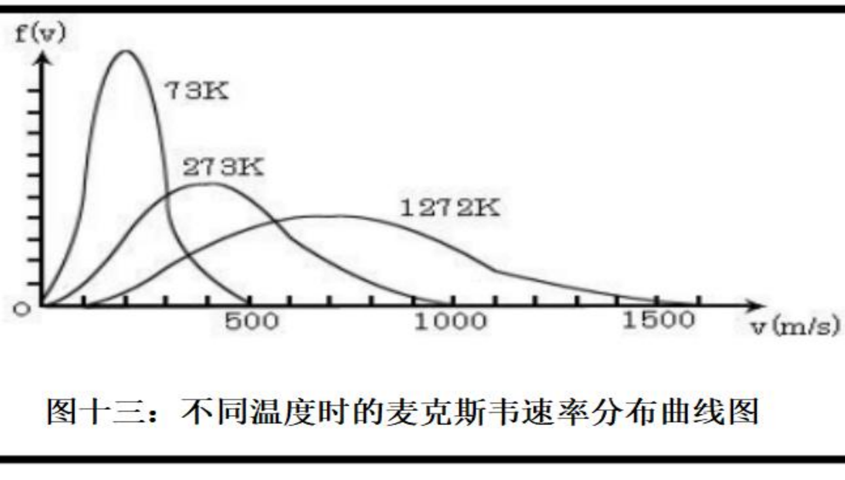
根据目前掌握的原子结构及其存在方式和运动规律可知：一般金属元素的原子外部电子处于不同能级、以不同速度、频率和不同距离高速绕原子核运动中。因此，要对这些电子进行加减速，就得像电动机一样施加一定相位和频率的交变电磁场。

3.1.2、照射光在金属表面附近产生的交变电磁场是外因

光是变化的电磁场，当光照射到金属表面时，将在金属表面附件形成与光的频率相同频率的交变电磁场。因此，当这种交变电磁场的频率和相位满足同步加速金属中的某些电子时，则电子将被同步加速。当加速到电子可逃逸原子核束缚的速度时，则将脱离金属的束缚而成为自由电子即光电子。这就产生了光电效应。

3.2、分子热运动速度分布是决定光电效应频率响应范围的重要因素之一

根据麦克斯韦速度分布律和黑体辐射强度分布规律可知：只要物体的温度不是绝对 0 度，则分子均处于不同的热运动状态之中。如下图十三所示，在金属板温度不变时，金属内部的分子/原子的热运动速度与同速度的分子/原子的数量间存在类似正态分布的关系。因此，金属中原子的外部电子的总体运动速度（相对由照射光产生的变化电磁场）为分子/原子热运动速度与电子绕原子核运动速度的叠加。当一定频率的光照射到金属表面时，符合同步加速的电子数量也会呈现出与分子/原子热运动速度分布律类似的分布规律。虽然电子绕原子核运动的速度一般为离散的不连续分布状态，但因分子热运动速度是连续分布的，使得电子相对由照射光产生的变化电磁场的总体速度分布就成为连续的了。这就是高于一定频率的照射光一般均可以产生光电效应的原因所在。



图十三：不同温度时的麦克斯韦速率分布曲线图

3.3、用电磁场同步加速解释光电效应可轻松化解光量子解释遇到的三大障碍

3.3.1、红限仅与材料性质有关与光强度无关的问题

在特定温度下，由于不同材料的原子外部电子的运动速度与分子热运动速度的叠加速度分布仅与材料中的原子类型有关。因此，其最低绕核运动频率和逃逸速度也仅与材料中的原子类型有关。这就决定了红限仅与材料性质有关，与光强度基本无关了。

3.3.2、光电子运动方向与光照射方向间夹角可大于 90 度的问题

由于照射光在金属表面产生的变化电磁场是垂直于光运动方向的。因此，电子被加速的方向也是垂直于光运动方向的。同时，由于分子热运动速度的叠加，使电子被加速到逃逸速度的位置可以是被加速区间的任意位置。由此导致光电子运动方向与光照射方向间的夹角可以是任意数值，因此存在大于 90 度的夹角也完全属于正常情况。

3.3.3、光电子数量不随照射光频率的上升而不断增加的问题

由于金属板内原子中的电子的运动速度和绕原子核的运动频率与原子数量间呈现类似正态分布。因此，高于一定频率的照射光使电子形成同步加速的难度也不断加大，自然产生光电子的数量就会减少。只有频率与电子绕原子核运动频率相近的照射光才能产生最多数量的光电子。这就很好地解释了为什么光电子数量不随照射光频率上升而增多的问题了。

4、用电磁场同步加速解释光电效应四项实验规律的尝试

4.1．每一种金属在产生光电效应时都存在一仅与材料性质有关而与光强度无关的红限

如上所述，每一种金属中的原子外部电子绕核运动频率一般与电子所处能级有关，最外层的电子绕核运动速度小、绕核周期长或频率低、受核约束力也最小，也是最容易被最先光电子化的。但每一种金属中的原子外部电子绕核频率均存在一个最小值，处于最小值频率的电子对应的电磁场同步加速频率也最小，此频率即为红限频率。因此，每一种金属的红限当然仅与材料性质有关，与光强度无关了。也可参见上节第 3.1 款的叙述。

4.2 光电效应中产生的光电子的速度与光的频率有关，而与光强无关

光电效应中产生的光电子的速度与电子脱离金属束缚的逃逸速度相关。一般金属材料中存在不同能级的电子。而不同能级的电子受到原子约束的力也不同，其逃逸速度也就不同。而不同逃逸速度的电子所需同步加速的电磁场频率也不同。也就是金属中的内层电子比外层电子受约束更大、绕核运动速度更高，绕核运动频率更高、更难逃离金属，需要达到同步加速的电磁场频率也就越高，一旦成为光电子，其运动速度自然更高。因此，当照射频率升高时，可以使金属中约束力更强、运动速度更高的电子也成为光电子。这些电子成为光电子后的速度当然会高于由频率更低的光产生的光电子的速度。也就形成了频率越高产生的光电子速度越大的现象。由于能否产生光电子仅与形成同步加速的光的频率有关，与强度无关。因此，光电子速度的变化也就与光的强度无关了。

4.3.光电效应的瞬时性，响应时间不超过十的负九次方秒（1ns）

一般金属产生光电效应的红限在可见光波段或更高频率段，一般频率均高于 $4.2*10^{14}$Hz，也就是周期小于 $2.38*10^{-15}$S。因此，光电效应响应时间为 1ns 的话，则在此时间段内，高于红限的光的周期数在 420000 周以上。对光电效应所需的电子同步加速的周期数完全足够多。实际上，同步加速到一定周期数后，由于电子运动速度的不断增加，将逐渐破坏同步加速条件，电子也获得了足够高的速度脱离原子核约束而飞出金属成为光电子了。从光照射到金属表面到电子逃离金属的过程虽然仅在 1ns 以内，但实际上的加速过程根本不需要那么长时间就能完成。当然，相比光的周期来说，光电效应响应时间根本不能称其为瞬时性了！

4.4.光电子数量与入射光的强度正相关。即在光频率不变时，入射光越强，一定时间内产生的光电子数量越多。

随着光的强度增加，光在金属表面附近产生的变化电磁场强度也会随之增加，影响金属的厚度范围也会增大。因此，被影响的原子数量也会增多，符合同步加速的电子数量也会增多。另一方面，由于电磁场强度的增加，电子被同步加速到逃逸速度所需时间也会缩短。原来一些不能被同步加速到逃逸速度的电子也可以被加速到逃逸速度成为光电子了。这样就导致了光电子数量随光的强度增加的现象。

综上所述，用爱因斯坦的光量子解释光电效应是存在严重缺陷和不足的。而用电磁场同步加速解释光电效应则不存在任何缺陷与障碍，几乎可以称其为完美和圆满。同时，这种解释方法也避免了不必要的光量子假设，而是从原子本身的客观实际出发，更加符合客观实际情况了。

三、康普顿效应的决定因素分析与物理含义

1、康普顿效应简介

康普顿效应是指Ｘ射线被自由电子散射的时候，散射出来的Ｘ射线分成两个部分，一部分和原来的入射射线波长相同，而另一部分却比原来的射线波长要长，具体的大小和散射角存在着函数关系。

2、康普顿效应机理分析

根据光与介质相互作用规律：入射的 X 射线会使金属中的原子中的电子与原子核改变运动状态并产生次生 X 射线。当入射 X 射线对不同视速度的电子和原子核作用而改变运动状态的能力不同且与视角度有关时，则不同视方向上的原子所产生的次生 X 射线的频率就会有所不同，即不同视速度的原子产生的次生 X 的频率与入射 X 射线不同且随散射角度变化，这就像所谓的红移机理一样。

3、康普顿效应的物理含义

康普顿效应进一步证明：光与介质相互作用规律是：入射光使介质中的原子被极化为次生光源并产生相应的次生光，并不是将所谓的入射光反射或散射出来。

四、星光红移量与距离成正比观测结果的机理及物理含义

1、哈勃常数及与观测频率的关系

1.1、哈勃常数

据相关资料记载：哈勃最初测量得到的哈勃常数为 500 km/s/Mpc；利用哈勃望远镜观测造父变星和标准宇宙烛光法计算星系的距离，给合星系红移量计算的哈勃常数为 74Km/s/Mpc；利用宇宙背景辐射观测数据与宇宙标准模型法得到的哈勃常数为 67.8Km/s/Mpc；而用红巨星代替标准烛光造父变量计算得到的哈勃常数为 69.8Km/s/Mpc。

1.2 哈勃常数与观测频率的关系

从三种测量方法所使用的接收星光频率段与所得到的实测数据分析可知：**哈勃常数值随使用的频率增加而增加。**即频率最低的宇宙背景辐射法为 67.8Km/s/Mpc；频率次高的红巨星法为 69.8Km/s/Mpc；而频率最高的造父变星法为 74Km/s/Mpc。这一规律可能正好说明天体红移量是由星际物质作用的结果：**频率越高的星光在星际物质中频率降低的速率越大**。

2、星光红移量与距离成正比的真实原因分析

2.1、星际空间存在一定密度的低温物质

根据天文观测：星际间的空域并非空无一物的理想真空。而是存在一定密度的低温物质。如：据 NASA 公开的信息，哈勃望远镜最新发现，仙女座已撞上我们银河系了。实际上是仙女座与银河系之间基本上都被气态物质所占据。

另据中国科学技术馆于 2020 年 09 月 03 日发表的《八个“放大镜”接力给暗物质晕“拍个照”》文介绍了有关给暗物质拍照的情况，并贴出了相关的照片如下：

2.2、星光红移量与距离成正比的真实原因分析

根据光与介质相互作用规律：地球人（包括太空中的望远镜）观测到的星光都是由星际物质产生的次生折射光，而并非由天体产生的原生光。因此，次生光的频率较入射光的频率发生些许降低是完全可能的，由此导致星光在星际物质一棒一棒的传递/再生过程中频率逐渐降低是完全正常的。当星际物质的分布在宏观上为基本均匀并各向基本同性时，就会得出星光红移量与距离成正比的现象了。

3、星光红移量与距离成正比的物理含义

星光红移量与距离正比的现象证明：星光并不是原生光，而是星际物质产生的次生光。这也是遥远的类星体的光谱存在多组红移量不等的发射与吸收谱线簇的根本原因。原则，类星体应该只有一组红移量才对。因为，类星体相对地球的视速度只有一个，如果红移为多普勒效应，就只能有一组红移量。正是因为存在不同视速度的星际物质，它们所再生的类星体的次生光的频率应会与类星体的原生光不同。

总之，用本文总结出来的光与介质相互作用规律可轻松解释目前几乎所有与光有关的物质现象与实验结果。这也从一个侧面证明：本文总结的光与介质相互作用规律应该是符合客观事实的，是正确无误的。

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