No.6

The essence of electromagnetic wave is not energy

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【Abstract】The customary opinion is: electric wave or light wave is energy, T.Yang's experiment is the interference of energy, its shading fringes are the energy magnitude. But, this article summarizes the physical experiments to point out: the essence of electric wave is not energy, and its shading fringes are not the energy magnitude, but the amplitude magnitude of the vector field. Then, this article summarizes all the experiments of electromagnetic wave, and derives the conclusion that the essence of the electric wave is not energy. Now that the essence of electric wave is not energy, as extension, this means that Maxwell's vector $\boldsymbol{E}\times\boldsymbol{H}$ (energy flux density) does not have the real physical implication, thus we can consider that electric field and magnetic field radiate independently.

【key words】energy, vector field, T.Yang experiment, physical essence, physical action

1 Introduction

If the radiation of electric wave is the radiation of vector field, when using vector field to analyze and calculate interference, diffraction, the conclusion should be coincident with the experiment. If it thinks that the radiation of electric wave is the transmission of wave energy, when using wave energy flux EH or $0.5\varepsilon E^2$ to analyze and calculate interference, diffraction, the conclusion should be coincident with the experiment, or it is not the action of wave energy.

If the physical action of electromagnetic wave is not the energy action of $\boldsymbol{E}\times\boldsymbol{H}$, we can not say that electric field and magnetic field are "mutual generation". Or, we think that electric field and magnetic field radiate independently. This is the starting point why this article researches the physical action of electric wave.

In the college physics books, when it teaches something about the interference and diffraction of light, the physical teacher first introduces the concept of light intensity I ($I\propto E^2$), it seems to tell us: the interference of light wave is the interference of energy, shading fringes are the energy magnitude, which coincides with Maxwell's wave energy and Poynting's energy flux density $\boldsymbol{E}\times\boldsymbol{H}(\propto E^2)$, also coincides with the wave equation of mechanical wave. So, we first point out: mechanical wave obeys Newton's mechanic law, the wave energy transmitted is conservation. Maxwell does analogy from mechanical wave to electromagnetic wave, such concept based on wave energy, but it is neither transmitting wave energy conservation nor radiating vector field conservation (see article 1). This article proves to indicate: as for the mechanical wave, it is transmitted through the oscillation of the medium, so it obeys Newton's mechanic law, so the wave energy $\mathrm{W_K}=\frac{1}{2}\rho(\Delta\mathrm{V})\mathrm{A}^2\omega^2$ that the mechanical wave transmits is conservation. ρ is the mass in the unit volume. But as for the electric field wave or magnetic field wave, the mass in the unit

volume is zero, there is no medium of oscillation-transmission, there is no force of oscillation-transmission either, so it is a kind of radiation, the conclusion of article [4] is, electric wave is a vector field that radiates independently, its field intensity is inversely proportional to distance square, if it takes the radiation source as the center, takes the spherical surface S_1 and S_2. So the field quantity which flows out of the surface S_1 equals the field quantity which flows out of the surface S_2, which is the conservation of radiation vector field, and obeys the inverse distance square theorem. This article further answered that all the physical actions of electric wave are the actions of independent vector field, not the action of wave energy flux $\boldsymbol{E}\times\boldsymbol{H}$. The purpose is to further negate the conclusion of Poynting's energy flux density $\boldsymbol{E}\times\boldsymbol{H}$ on the basis of physical concept, which is further proving that electric wave is the vector field that radiates independently on the basis of physical concept.

This article starts from the interference of electric wave, transmission of electric wave and other physical actions, analyzes and concludes that "the radiation of electric wave is not the transmission of wave energy, but the radiation of vector field". The main conclusions include: 1) The interference and diffraction of electric wave are the interference and diffraction of independent vector field, not the interference and diffraction of wave energy flux $\boldsymbol{E}\times\boldsymbol{H}$, it especially points out that T.Yang experiment is just the interference of vector field, not the interference of energy, shading fringes are the amplitude magnitude of vector field, but not the scalar energy magnitude, 2) The reflection and refraction of electric wave are the reflection and refraction of independent vector field, not the reflection and refraction of wave energy flux $\boldsymbol{E}\times\boldsymbol{H}$, 3) The radiation of electric wave is the radiation of independent vector field, not the radiation of wave energy flux $\boldsymbol{E}\times\boldsymbol{H}$, 4) The reception of electric wave is the reception of independent vector field, not the reception of wave energy flux $\boldsymbol{E}\times\boldsymbol{H}$, 5) Electric wave radiation vector field is conservation, but Maxwell's curl field is neither transmitting energy conservation nor radiating vector field conservation, 6) Sine and cosine electric field, magnetic field are virtual power, sine and cosine electric field, magnetic field are not energy. Electric field wave and magnetic field wave are virtual powers, their essence is not energy. Microwave acting on the object will be transformed into the thermal energy, it is not the "direct transmission from one energy to another energy", but after the vector field acts on the object, it generates thermal energy under Lorentz force, which is the same as the photosynthesis of the plant, there exists a transformation procedure, it is also the same as the that force acting on the object to generate kinetic energy, there exists a transformation procedure. Force $F=ma$ and electric wave force (electric field force $qE(t)$, magnetic field force $qvB(t)$) are both not energy.

So the conclusion of this article is: all the physical actions of electric wave are not the actions of wave energy ($\propto \boldsymbol{E}\times\boldsymbol{H}$), but the action of independent vector field, The essence of electric field wave and magnetic field wave is not energy, but the virtual power, it acts as the wave, radiation vector field conservation, and the light wave with the wave length close to atomic size can still be calculated by following Planck quantum hypothesis on quantization treatment.

2 The interference of light is not the action of energy, but the action of independent vector field

In the college physics books, when teaching something about the interference and diffraction of light, the physics teacher first introduces the concept of light intensity (light energy), it seems to tell us: the interference of light is the interference of energy. It uses the light energy as introduction before introducing T.Yang experiment in the current college physics book. The textbook describes below: because of the light intensity $I \propto E^2$, the synthesized light intensity of two bundles of coherent lights is : $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos(\varphi_2 - \varphi_1)$. When $I_1 = I_2$, there is

$$I = 2I\left[1+\cos(\varphi_2 - \varphi_1)\right] = 4I_1 \cos^2\frac{\Delta\varphi}{2} \qquad (1)$$

When $\Delta\varphi$ is the even multiple of π, there displays bright fringes, which equals four times as the single light source intensity I_1, When $\Delta\varphi$ is the odd multiple of π, there displays dark fringes, the light intensity I =0.

Then, the college physics textbook introduces T.Yang experiment. It seems to tell people "T.Yang's double-slit interference is the interference of energy", the shading fringes are the energy magnitude.

We can verify: substitute $\Delta\varphi$ when it is the even multiple of π into the formula(1), it can not derive the bright fringes of T.Yang, substitute $\Delta\varphi$ when it is the odd multiple of π into the formula(1), it can not derive the dark fringes of T.Yang either. Which is that, formula (1) does not comply with the experimental result. So, the interference of light is not the interference of energy. Only when calculating according to the independent vector field, it can derive the experimental conclusion of T.Yang, see formula (5、6). Which is that, shading fringes are the vector amplitude magnitude, but not the magnitude of scalar energy.

2.1 The interference of light is not the interference of wave energy

Suppose, it uses Poynting vector $\boldsymbol{P} = \boldsymbol{E} \times \boldsymbol{H}$ or $\boldsymbol{w} = (EH)\boldsymbol{e}_k$ to denote the energy flux of two bundles of lights, (note: $\boldsymbol{e}_k$ is the direction of energy flux) see figure 1. Which is:

$$\begin{cases} w_1 = \sqrt{\dfrac{\varepsilon}{\mu}} E_0^2 \cos^2(\omega t - \dfrac{2\pi r_1}{\lambda}) \\ w_2 = \sqrt{\dfrac{\varepsilon}{\mu}} E_0^2 \cos^2(\omega t - \dfrac{2\pi r_2}{\lambda}) \end{cases} \qquad (1)$$

In the formula, ε *and* μ are the dielectric constant and permeability in the free space. The synthesized density at the point o that two energy fluxes reach on the screen

$$\begin{aligned} w &= w_1 + w_2 \\ &= \sqrt{\frac{\varepsilon}{\mu}} E_0^2 \left[\cos^2(\omega t - \frac{2\pi r_1}{\lambda}) + \cos^2(\omega t - \frac{2\pi r_2}{\lambda}) \right] \\ &= w_0 \left\{ 1 + \cos\left[\frac{2\pi}{\lambda}(r_2 - r_1) \right] \cdot \cos(2\omega t - \phi) \right\} \end{aligned} \qquad (2)$$

Here $\phi = \dfrac{2\pi}{\lambda}(r_1 + r_2)$, 2ω in the formula denotes that the energy flux density varies according to the

angular frequency 2ω . Formula (2) indicates:

When $r_2 - r_1 = \pm k\lambda,\ \ k = 1,2,3,\ \ w = w_0[1+\cos(2\omega t - \phi)]$, the module value is $2w_0$

When $r_2 - r_1 = \pm(2k-1)\lambda,\ \ k = 1,2,3,\ \ w = w_0[1-\cos(2\omega t - \phi)]$, the module value is still $2w_0$. The energy density under these two situations are the same, there is no interference fringes. But in fact: when $r_2 - r_1 = \pm k\lambda,\ \ k = 1,2,3$, there displays the bright points, while when $r_2 - r_1 = \pm(2k-1)\frac{\lambda}{2},\ \ k = 1,2,3$, there displays the dark points, and exists the interference fringes, so double-slit interference such physical action is not the action of wave energy. Obviously, after Maxwell's "twin energy flux $w = EH$ " is negated, whether $w = \varepsilon E^2 c$ can be used to describe the interference of light microwave? The answer is no.

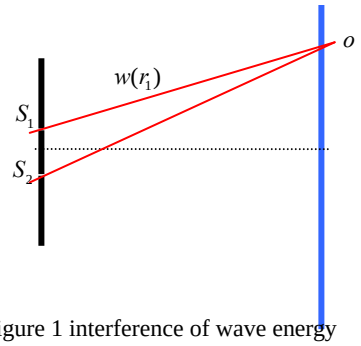

Figure 1 interference of wave energy

Let's have a try, suppose two bundles of electric field energy density which reach the screen are respectively

$$\begin{cases} w_1 = \varepsilon E_0^2 \cos^2(\omega t - \dfrac{2\pi r_1}{\lambda}) \\ w_2 = \varepsilon E_0^2 \cos^2(\omega t - \dfrac{2\pi r_2}{\lambda}) \end{cases} \tag{3}$$

In the formula, c_0 is the light speed in the vacuum. The synthesized density which two energy fluxes reach at the point o of the screen is

$$\begin{aligned} w &= w_1 + w_2 \\ &= \varepsilon E_0^2 \left[\cos^2(\omega t - \frac{2\pi r_1}{\lambda}) + \cos^2(\omega t - \frac{2\pi r_2}{\lambda}) \right] \\ &= w_0 \left\{ 1 + \cos\left[\frac{2\pi}{\lambda}(r_2 - r_1) \right] \cdot \cos(2\omega t - \phi) \right\} \end{aligned} \tag{4}$$

Here $\phi = \frac{2\pi}{\lambda}(r_1 + r_2)$, 2ω in the formula denotes that the module value of energy flux density varies according to the angular frequency of 2ω . The above formula indicates:

When $r_2 - r_1 = \pm k\lambda,\ \ k = 1,2,3$, $w = w_0[1+\cos(2\omega t - \phi)]$, the module value is $2w_0$, when $r_2 - r_1 = \pm(2k-1)\lambda,\ \ k = 1,2,3$, $w = w_0[1-\cos(2\omega t - \phi)]$, the module value is still $2w_0$. The energy density under two situations are the same, there are no interference fringes. But in fact, there

exists interference fringes under the above two situations, so double-slit interference, such a physical action is not the action of wave energy, or, the essence of wave is not energy, but the field. In fact, it is easy to prove, all the interferences (including equal inclination interference, splitter interference, film interference, Michelson interference, and Newton ring, biprism interference, Lloyd mirror and Laue spot and so on) are all not the action of wave energy.

2.2 Interference of light is the interference of independent vector field

1. Interference of light wave is the interference of independent vector field. There are many kinds of light wave interference, now it takes the double-slit experiment of T.Yang as the example. As shown in the figure 2, the interference fringes are the physical phenomena which such physical action happens. Investigating such physical phenomena, which is the calculation of fringes, can be based on the viewpoints of vector field, also the viewpoints of wave energy. If there derives the same conclusion on these two kinds of viewpoints, we can say that it has these two kinds of characters simultaneously. Or, it is not

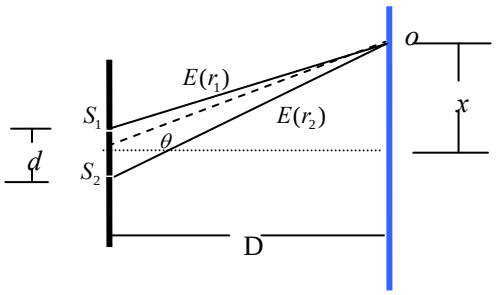

Figure 2 interference of the vector field

In such physical action, when we analyze based on the viewpoint of field vector, the electric field vector of two bundles of electric wave's reaching screen is denoted as

$$\begin{cases} E_1 = E_0 \cos(\omega t - \dfrac{2\pi r_1}{\lambda}) \\ E_2 = E_0 \cos(\omega t - \dfrac{2\pi r_2}{\lambda}) \end{cases} \tag{5}$$

In the formula, r_1 and r_2 are the respective wave paths. The synthesized field vector of the electric wave after superposition is $\boldsymbol{E} = \boldsymbol{E}_1 + \boldsymbol{E}_2$. If the electric wave vectors have the same directions, the synthesized field intensity at the point o on the screen is:

$$\begin{aligned} E &= E_0 \cos(\omega t - \frac{2\pi r_1}{\lambda}) + E_0 \cos(\omega t - \frac{2\pi r_2}{\lambda}) \\ &= 2E_0 \cos[\frac{\pi}{\lambda}(r_2 - r_1)] \cdot \cos[\omega t - \frac{\pi}{\lambda}(r_1 + r_2)] \\ &= 2E_0 \cos\Delta\varphi \cdot \cos[\omega t - \frac{\pi}{\lambda}(r_1 + r_2)] \end{aligned} \tag{6}$$

Here $\Delta\varphi = \dfrac{\pi}{\lambda}(r_2 - r_1)$, as for the formula (6), there is:When $r_2 - r_1 = \pm k\lambda,\ k = 0,1,2,3$,

$E = 2E_0 \cos\left[\omega t - \frac{\pi}{\lambda}(r_1 + r_2)\right]$, there displays bright fringes on the screen.

When $r_2 - r_1 = \pm(2k-1)\frac{\lambda}{2}$, $k = 1,2,3$, $E = 0$, there displays dark fringes on the screen.

Notice that $r_2 - r_1 \approx d \cdot \sin\theta \approx d \cdot tg\theta = \frac{xd}{D}$, so

When $\frac{xd}{D} = \pm k\lambda$, $k = 0,1,2,3$, $E = 2E_0 \cos\left[\omega t - \frac{\pi}{\lambda}(r_1 + r_2)\right]$, there displays bright fringes on the screen.

When $\frac{xd}{D} = \pm(2k-1)\frac{\lambda}{2}$, $k = 1,2,3$, $E = 0$, there displays dark fringes on the screen. The interval among the fringes is $\frac{d}{D}\lambda$.

The above is analyzed by independent vector field, which is coincident with the experiment. And it proves that T.Yang experiment is the experiment of independent vector field. In other words, T.Yang interference experiment proves that the interference of light is the interference of vector field, which proves that formula (6) is correct. So, double-slit interference obeys ***E*** vector superposition principle, which is the interference of the vector field, which belongs to the action of field vector. In fact, it is easy to prove, all the interferences (including equal inclination interference, splitter interference, film interference, Michelson interference, and Newton ring, biprism interference, Lloyd mirror and Laue spot and so on) obey vector superposition principle of independent field, which is the action of field vector.

The above analysis is using independent electric field ***E*** to describe, and it is the same to use independent magnetic field ***H*** vector to analyze.

3 The radiation of electric wave is not the action of wave energy, but the action of independent vector field

3.1 The radiation of electric wave is not the transmission of wave energy

Let's us see the microwave radiation and the radiation procedure during the radio communication.

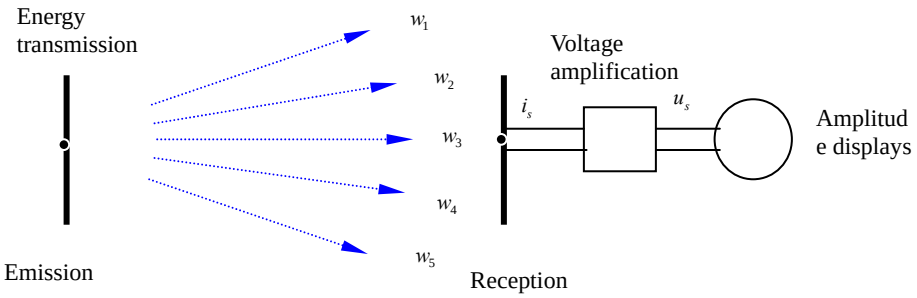

Figure 3 if it is the energy transmission

Suppose there is a emission oscillator and reception oscillator, and it is far between the reception antenna and emission antenna, $r \gg dl$. In the communication application, if the radiation of electric wave is the radiation of wave energy, shown in the figure 3, when the energy density w_r acts on the reception antenna(a thin wire), it does not generate the signal current, because w_r is perpendicular to the reception antenna. In addition, if the reception antenna receives electromagnetic energy w_r, it is not important for the reception antenna to parallel with the emission antenna. But, it is rather important in fact. Actually, the reception antenna in the figure is not "pocket", which also can not receive wave energy.

In order to explain further, the reception signal does not receive the energy, please refer to (a) and (b) in the figure 4, in each figure, the left signal source and right signal source have the same frequency and phase, also the circuits are identical. Wire $\overline{ab}$ is between two emission antennas, and parallels to the emission antenna, which can be considered as the reception antenna.

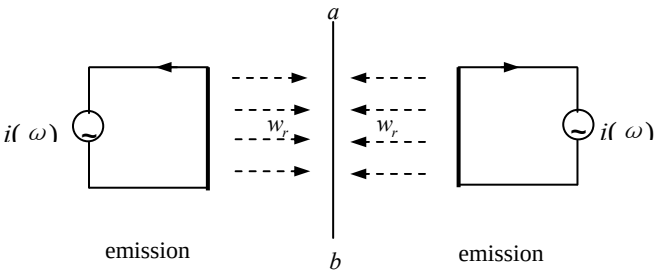

Figure (a) Equal distance

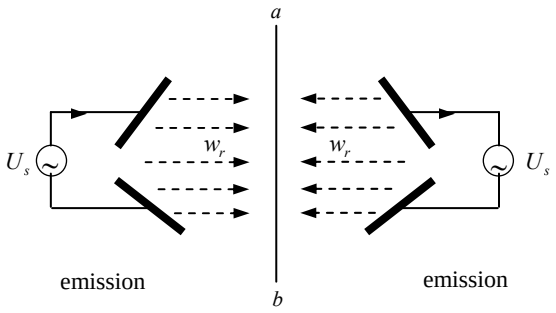

Figure (b) Equal distance

Figure 4 Transmission with the identical frequency, amplitude, phase, and symmetry.

Now that all the actions of electric wave's volatility are the actions of independent vector field, but not the action of coexistent $\boldsymbol{E} \times \boldsymbol{H}$ energy, so it is reasonable for us to determine, electric wave radiating vector field is conservation, which is, each radiation vector field of electric field wave and magnetic field wave are conservation. Actually what the $\boldsymbol{E} \times \boldsymbol{H}$ derived from Maxwell curl theory is the polynomial of distance r, which is neither the conservation of transmitting wave energy, nor the conservation of radiation vector field, but a negative energy value, which is obviously not

complying with the objective fact.

Suppose (in the figure 4), if the radiation of electric wave is the transmission of energy W, the reception antenna will receive the W from the left side, and also receive the W from the right side. Because energy W is scalar, so the reception antenna $\overline{ab}$ totally receives $2W$, which is that, the received signal current increases twice compared with under the single transmitter. But, it is actually opposite, it can completely prove that the current on the wire $\overline{ab}$ in the figure is zero, why? Because we think (the fact should have been like this), the radiation of electric wave is the radiation of vector field, the reception of electric wave is the reception of vector field. Because vector has direction, the vector fields on the wire $\overline{ab}$ are just counteracted to be zero. So, we strongly think: the reception of signal is not the reception of wave energy.

3.2 Electric wave radiation is the radiation of independent vector field

Suppose there is an emission oscillator and reception oscillator, shown in the figure 5. The reception antenna and emission antenna are far from each other, $r \gg dl$, so, the electric wave reached to the reception antenna can be considered as shear wave, please note, there are three parameters on reaching to the reception antenna: E_θ, H_φ, w_r. As for the radiation of electric wave, whether it directly radiates E_θ and H_φ? Or it directly transmits energy flux density w_r? It negates the receiving wave energy such opinion previously, the viewpoints based on field vector radiation are discussed below:

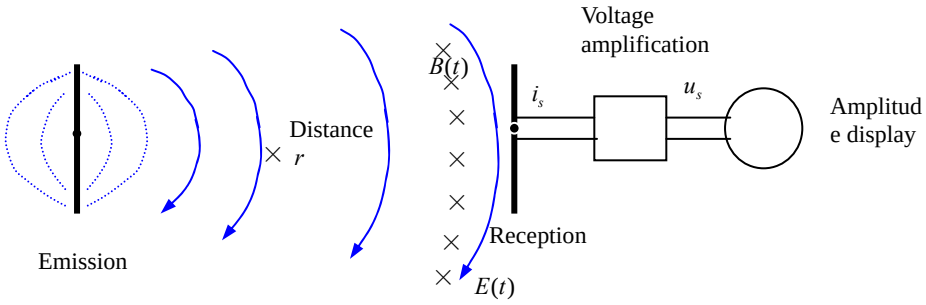

Figure 5 Figure of the emission and reception of the electric wave-----field vector radiation

According to what article 1 and 2 discuss, the radiating time variable electric field $E_\theta(t) \propto \frac{1}{r^2}$, radiating time variable magnetic field $B_\varphi(t) \propto \frac{1}{r^2}$, metal electrons on the reception antenna under $E(t)$ and $B(t)$, will be forced by Lorentz electric force $e\boldsymbol{E}(t)$ and Lorentz magnetic force $e(-\boldsymbol{c}_0)\times\boldsymbol{B}(t)$, metal electrons move up and down, and generate the signal current. So the magnitude of signal current $i(t) \propto \frac{1}{r^2}$, current multiplying impedance is the voltage, the amplitude $U_m \propto \frac{1}{r^2}$ is added to oscilloscope, after being amplified by the voltage, the amplitude $U_m \propto \frac{1}{r^2}$ is

added to oscilloscope, which is the inverse distance square theorem familiar with everyone. Here, our conclusion is, radiation action is the radiation of vector field, reception action is receiving the vector field.

In order to further prove that such conclusion is correct, please refer to (a) and (b) of the figure 6, in each figure, the left signal source and right signal source have the identical frequency, phase, and the circuits are also identical. Wire $\overline{ab}$ is between the two emission antennas, and parallels to the emission antenna, which can be considered as the reception antenna. It can test, the current on wire $\overline{ab}$ is zero, which is the result of the superposition (counteract) of the positive and negative vectors.

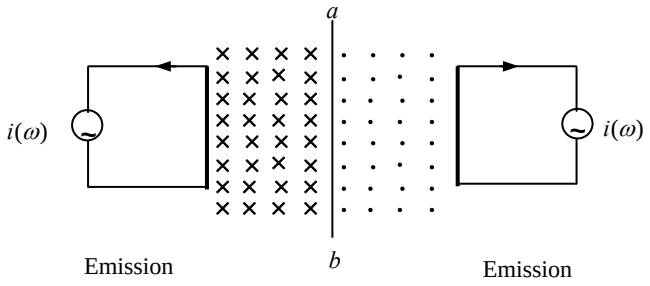

Figure (a)

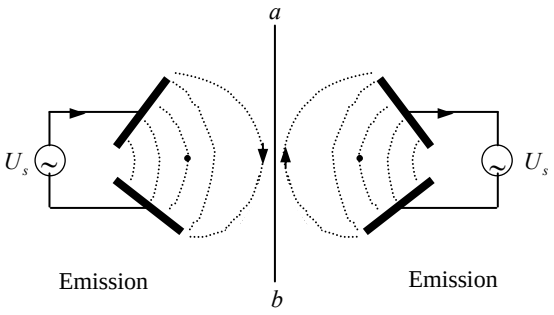

Figure (b)

Figure 6 field vector counteract in the symmetric radiation

Suppose, if it radiated the energy, what would be the energy that the reception antenna $\overline{ab}$ in the figure receives? It does not comply with the fact. So this article thinks, electric wave is not the action of energy.

The above analysis is using independent electric field $\boldsymbol{E}$ to describe, and it is the same to use independent magnetic field $\boldsymbol{H}$ vector to analyze.

4 The essence of time variable electromagnetic field is not energy

Since the birth of Maxwell theory, wave equation and Poynting vector, people have always been thinking that microwave radiates the wave energy. The current theory thinks: $w = EH = c\varepsilon E^2 = c\mu H^2$ has the dimension of energy flux density, the mean value of the wave

energy which flows through the sectional area s, within the time t, is $\frac{1}{2}c\varepsilon E_m^2 st$. According to it, it seems that microwave black box can store wave energy, microwave heating is the energy exchange. We also usually hear the saying of "microwave energy", and there is the terminology of microwave energy transforming into the heat and so on. It seems to say that microwave itself is energy, and when such kind of microwave acts on the object, the energy is directly passed to the object.

Through the explanation below, we will realize that, time variable electromagnetic field is virtual power, the microwave itself does not have the character of wave energy, its acting on the object is after the vector field activates the object, it is transformed into heat, not the direct transmission of the wave energy. Here, we need to note, "vector field activates into heat" and "wave energy exchanges into heat" are two different physical change procedure and physical concepts.

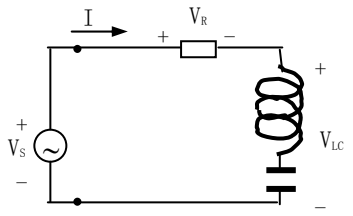

Figure 7 Sine and cosine electromagnetic field is virtual power

As for the intensive parameter elements (circuit size is far less than wave length), the circuit that contains reactance, the solution is: full response equals transient response + stable response. What we are interested is the physical character of sine and cosine microwave, generated by such sine and cosine stable response.

As it is known, in the port circuit composed of reactance, under sine and cosine stable state, the port voltage is $v(t) = V_m cos(\omega t + \varphi)$, port current is $i(t) = I_m \cos(\omega t + \angle \boldsymbol{I})$, and the relative complex power is $P = \frac{1}{2}V_m I_m \cos(\angle \boldsymbol{V} - \angle \boldsymbol{I}) + \boldsymbol{j}\frac{1}{2}V_m I_m \sin(\angle \boldsymbol{V} - \angle \boldsymbol{I})$. In the formula, $\angle V$ is the voltage angle, $\angle I$ is the current angle. The right first term is real power, and the second term is virtual power. Real power consumes energy, and the virtual power does not consume energy.

Solving such circuit to derive, the average complex power that the power port provides is:

$$P_s = \frac{1}{2}\frac{V_m^2 R\omega^2 C^2}{(\omega RC)^2 + (\omega^2 LC - 1)^2} + \boldsymbol{j}\frac{1}{2}\frac{V_m^2 \omega^3 LC^2}{(\omega RC)^2 + (\omega^2 LC - 1)^2} - \boldsymbol{j}\frac{1}{2}\frac{V_m^2 \omega C}{(\omega RC)^2 + (\omega^2 LC - 1)^2} \qquad (7)$$

The average complex power of the resistance port is : $P_R = \frac{1}{2}\frac{V_m^2 R\omega^2 C^2}{(\omega RC)^2 + (\omega^2 LC - 1)^2} + \boldsymbol{j}0$

The average complex power of the inductance is (being positive) $P_L = 0 + \boldsymbol{j}\frac{1}{2}\frac{V_m^2 \omega^3 LC^2}{(\omega RC)^2 + (\omega^2 LC - 1)^2}$.

The average complex power of the capacity port is (being negative) $P_C = 0 - \boldsymbol{j}\frac{1}{2}\frac{V_m^2 \omega C}{(\omega RC)^2 + (\omega^2 LC - 1)^2}$

Especially in the resonance, because $\omega^2 LC = 1$, so, the relative average complex power is:

1) The average complex power of the inductance port is (being positive) $P_L = j\frac{1}{2}\frac{V_m^2}{\omega R^2 C}$

2) The average complex power of the capacity port is (being negative) $P_C = -j\frac{1}{2}\frac{V_m^2}{\omega R^2 C}$

The conclusion is below through the calculation and analysis above: under the sine stable state, the energy which voltage source provides fully acts on the resistance, while although there continuously generates time variable electric field and time variable magnetic field in the LC port, they don't consume energy, which is the virtual power. If there exists a certain kind of exchange between them, it will be between the positive virtual power in the inductance and the negative virtual power in the capacity. Expand L , C in the figure, and it radiates to the free space, which indicates that the time variable electromagnetic field in the free space is virtual power, not the energy.

5 Epilogue

This article investigates the natural character of electric wave itself, centered on the internal connection between phenomenon and essence, and the necessary connection between action and theorem. When we say that interference is not the character of energy, it means that the interference of electric wave is not the action of energy. Also, such physical action can not calculated, analyzed and described through the viewpoint of wave energy. Or, if it uses energy or energy flux density to describe the interference, it will not comply with the objective facts. When we say that the transmission of electric wave does not obey the energy conservation of electric wave, it means that, the transmission of electric wave is not the transmission of energy, but the transmission of vector field, which also means that such physical action can not be calculated, analyzed and described through the viewpoint of energy. Or, if it uses energy or energy flux density to describe reflection and refraction, it will not derive the reflection and refraction equation, even there will come out "energy increases". When we say that the transmission of electric wave is not the transmission of energy, it means that the substance which electric wave transmits is vector field, not the wave energy. Or, if the transmitted substance is wave energy, when using energy to investigate the received light intensity, it will not comply with the fact. Maybe, if the transmission of light is not only the transmission of field, but also the transmission of energy, when using these two viewpoints to describe the light intensity, the answers should be the same, but, it is actually opposite. Based on many of the analysis above, we have proof to think, the radiation of electric wave is not the radiation of energy.

What is worthwhile to note is, when the electric wave is under a certain condition and acting on a special object, it can be transformed into energy, which is the leap from quantitative change to qualitative change. This chapter is not discussing the procedure of qualitative change, but discussing the natural character of electric wave before that leap. Whether electric field, magnetic field, or force field, when they act on the special object under a certain condition, they must be transformed into a certain energy, which is no doubt. Once it is transformed into energy, the energy is conservation, which is also unavoidable. Force (constant force or time variable force) acts on the

object, it can be transformed into kinetic energy, but the essence of force (constant force or time variable force) is not energy, which seems to resemble electric field, magnetic field. In the past, the study which people did on the action of force was perfect, and it does not need to improve anymore. Now, the study that people does on the action of field just starts, and it needs further research. Because the mechanism which field and substance interact is not completed debunked yet, so that some people consider the individual phenomena as truth, to misunderstand "electric wave is energy", and I have to say that it is a very regretful thing.

To say the above conclusion simply, electric wave does not directly radiate wave energy, but radiates vector field. Such conclusion has nothing to do with the wave particle duality and quantum hypothesis. We say that the electric wave itself is successive, but we don't disagree with quantifying such successive stuff-----for example, wave, photons. Because, it does not matter whether quantification or digitalization, they are both convenient to calculation. Especially the high frequency light wave, ultraviolet, x ray and γ ray, the higher the frequency is, the more particle essence it displays. Or, when reaching x ray such a frequency limit, because the wave length can be compared with the electrons size, it mainly shows the particle character, or to say that it is mainly the particle.

Although light wave and the rays with higher frequency has "particle character", which has been accepted by many people, and becomes very popular, but it does not influence the conclusion "the radiation of electric wave is the radiation of field vector, and obey the radiation vector field conservation", because the "particle character" belongs to scope of "duality". For example, the diffraction of the electron flow emitted from the cathode displays the shape of concentric rings, although the diffraction has the wavelike phenomena, we can not say that the motion of electron flow transmits wave energy. There is a kind of shotgun in China, there is filled with the small size metal balls in the bore, after shooting, there displays concentric spots on the target, although it has the same volatility, we can't say that the motion of metal balls transmits the wave. The same thing, for example, the dipole emission antenna with the power one kilowatt, frequency one megahertz, radiates the vector fields which are $\boldsymbol{E} \propto \frac{1}{4\pi r^2}$ and $\boldsymbol{B} \propto \frac{1}{4\pi r^2}$ to the free space respectively, we can only say that it radiates vector field, and can't say that it radiates particle. When we say "the radiation of electric wave does not have energy character", it mainly means that during the radiation, it radiates in the vacuum as the essence of vector field, but when it interacts with the object, it might display the particle character in some circumstance, and be transformed into energy. This section negates "electric wave energy theory".

It can prove actually, all the electric wave actions can not be analyzed by the viewpoint of wave energy. Many physical experiments indicate, all the actions of electric wave are the actions of independent field vector, but not the direct action of wave energy. Of course, light wave acting on the black body can generate heat radiation, light wave acting on potassium oxide diode can generate current, light wave acting on the skin can make people feel hot, light wave acting on the plant can generate photosynthesis, light wave acting on the electrons can generate diffraction, and so on, these qualitative changes happen between the light wave and object, during the qualitative change, there

generates heat or other kinds of energy, the minimum unit of transformation can be calculated according to energy quantum hf . In other words, in order to calculate more conveniently, it can be quantified.

【The wording in the article can be modified, the length of the article can be compressed】

Reference

1. Zeng Qingping. ***The Summary of Natural Science Principles*** *-- **Interpretation about the important difficult problems of physics law***. Science publisher of Hubei, in Wuhan,China,2009.6

2. Zeng Qingping.Summarization of Question on EM Theory, Proceedings of ILLMC' 19941.

3. Zeng Qingping.Summarization of Negative to Maxwell's EM Theory, Proceedings of ILLMC' 1995.

4. Zeng Qingping.Problems on Demonstration of the Electric Field Producing the Magnetic Field.Proceedings of ICMMT'98. (ISTP).

5. Zeng Qingping.Problems on Demonstration of the Magnetic Field Producing the Electric Field. Proceedings of ICMMT'98. (ISTP).

7. Zeng Qingping.Questions on Maxwell's Electromagnetic Field Theory. Proceed-ings of ICEEA'94. (SCI).

7. Zeng Qingping.Negative Viewpoints to Maxwell's Electromagnetic Field The-ory.Chinese Journal of Radio Science, or Proceedings of ICRS' 95, p127～132.

8. Zeng Qingping.On Theory of Relativity in Mass Spectrometer. Proceedings of CMSC' 99, in China.

9. Zeng Qingping.Questions on EM Theory and the Separative Viewpoints on Elec-tric field and Magnetic field, Journal of Air Force Radar Academy, VoL. 9. 1996.3.

10. Zeng Qingping. Summarization of Question on EM Theory, Proceedings of ILLMC' 2001.

11. Zeng Qingping. Summarization of Negative to Maxwell's EM Theory, Proceedings of ILLMC' 2001.

Expecting the references that you published

[1]Disputes Existing in the Physical Natural of Electromagnetic Induction.

[2]Verification of General Lorentz Magnetic Force.

[3]Experimental Method to Negate Maxwell Theory.

[4].Mathematical Model of Independent Radiation Magnetic Field.

[5]The Essence of Electric Wave Is not Energy.

[6] About the Physical Essence of Michelson-Morley Experiment.

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[8] Compton's Scattering Experiment of Roentgen Rays Obeys Newton's Law.

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