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A NEW PHYSICS THEORY ABOUT THE KINETIC FORCE MECHANISM OF ENERGY FLOW

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ABSTRACT

In this paper, according to the characteristics of massless field, the kinetic force mechanism based on the flow and variation effects of power is firstly proposed. This mechanism shows that when the massless field is moving and changing, the power received by the moving stressed object have flowing and changing state, therefore when this type of power is transferred to the stressed object in the form of energy flow, the stressed object will receive the kinetic force effects corresponding to the energy flow. According to the kinetic force mechanism, this paper has proposed the concepts of dynamic field force and variable field force and has established the expressions of dynamic field strength and variable field strength for the massless field with moving and changing state. Inspired by the kinetic force mechanism, some physical problems have been solved: the magnetic effect of electric field is essentially explained, the condition under which electromagnetic waves are excited is effectively described, the possible dynamics of the gravitational field under the conditions of motion and change is predicted, the possibility and generation mechanism of gravitational waves is demonstrated.

Keywords: Kinetic Force Mechanism, Energy Flow Law, Power Flow, Power Change, Dynamic Field Force, Variable Field Force, Kinetic Force, Dynamic Field Strength, Variable Field Strength, Electromagnetic Field, Gravitational Field

1. INTRODUCTION

At present, the study of physics has been very advanced, which is embodied in the perfect description of physical laws and the development of advanced technologies Bhat and Taylor (2020), Callahan (2000), Hey and Walters (2009), Lederman (1989), Ma (2017), Ma (2017). However, some physical problems are perfect in description by classical laws but are difficult to essentially explain with basic mechanisms. For examples: (1) Why do moving and changing electric fields produce magnetic effects? (2) Why is the gravitational wave existing in theory difficult to detect in practice? (3) Why is our living space three-dimensional? (4) How to explain the quantum dynamic equations based on the basic physical mechanism? (5) Is there any variability of Planck constant under specific conditions? (6) How to objectively understand that the square of imaginary number is a negative value in the numerical mechanism? (7) Why do some particles have singularities and quantum number constrained states? (8) Why is the speed of light invariable in vacuum?

For many years I have been thinking deeply about these problems and have explained the above (3-8) questions by proposing more basic principles Ma (2018), Ma (2020), Ma (2020), Ma (2022), Morgan and Pennington (1987), Ramos et al. (2020). Especially the first and second problems mentioned above have not been solved yet, so I have thought deeply about these two issues for a long time, finally a basic mechanism is proposed: for massless fields the kinetic force mechanism of power flow and variation exist. Using this new physical mechanism, we can solve the above two questions, so the relevant ideas are specifically analyzed, expressed, and discussed in the following.

2. KINETIC FORCE MECHANISM BASED ON THE FLOW AND VARIATION EFFECTS OF POWER

Kinetic force mechanism: for the massless field in the state of motion and change, the power supplied to the moving stressed object has the effect of flow and change, so the stressed object can receive the kinetic force provided by energy flow.

2.1. KINETIC FORCE EFFECTS CAUSED BY FLOW AND VARIATION OF POWER

The force effect of flowing and varying power: For the massless fields such as electric field and gravitational field, the field strength is provided by the field source and is static relative to the field source, so the movement of the field source and the change of the field charge cause the movement and change of the field strength at a fixed point in space; Under this condition, the dynamic object can receive power supplied by static force at the point, and the received power also have motion and change effects due to the movement and change of field strength; The flow and change of power is essentially the flow of energy, therefore the flow and change of power make the stressed object receive the flow of relevant energy; This kind of energy flow obviously has momentum, so in the transmission of energy and momentum, the dynamic force bearing object can further feel the force effect generated by energy flow. The specific analysis and expression of this effect are as follows.

First, according to classical physics, the expression of static massless field, static force and power need to be described. In Formula (1), Q and q is respectively the force charge of field source and stressed object; $\vec{r}_p$ and $\vec{r}_Q$ is respectively the position vector of a space field point and field source; When the force charge q moving at a speed $\vec{v}$ reaches the position $\vec{r}_p$, the force charge is subject to static field force $\vec{f}_s$, and the power w is formed under the action of the static field force.

$$\vec{r} = \vec{r}_p - \vec{r}_Q, \frac{d\vec{r}_p}{dt} = 0, \frac{d\vec{r}_Q}{dt} = \vec{u}, \frac{d\vec{r}}{dt} = \frac{d\vec{r}_p}{dt} - \frac{d\vec{r}_Q}{dt} = -\vec{u}$$

$$\vec{E} = KQ\frac{\vec{r}}{r^3}, \vec{f}_s = q\vec{E} = KqQ\frac{\vec{r}}{r^3}, w = \vec{f}_s \cdot \vec{v} = q\vec{v} \cdot \vec{E} \qquad \text{Equation 1}$$

Obviously, according to the expression of Equation 1, when the field source moves at speed $\vec{u}$, the field strength at the target position $\vec{r}_p$ will inevitably change, and the power will also change. At the same time, the change possibility of force charge for field source is also considered, so the variation of field strength and power is expressed as follows:

$$\partial_t \vec{E} = \frac{d}{dt}\left(KQ\frac{\vec{r}}{r^3}\right) = K\frac{Q}{r^3}\left(\vec{r}\frac{\partial_t Q}{Q} - \vec{u} - \frac{3\vec{r}}{r}\partial_t r\right)$$
$$\partial_t w = \frac{d}{dt}(\vec{f}_s \cdot \vec{v}) = q\vec{v}\cdot\frac{d\vec{E}}{dt} = K\frac{Q}{r^3}(q\vec{v}\cdot\vec{r}\frac{\partial_t Q}{Q} - q\vec{v}\cdot\vec{u} - 3\frac{q\vec{v}\cdot\vec{r}}{r}\partial_t r) \qquad \text{Equation 2}$$

According to Equation 2, under the possible conditions of field source motion and force charge change, the transmitted power has two characteristics: On the one hand, power w has the same motion speed $\vec{u}$ as the field source, so the flow of power forms the energy flow $\vec{s}_u$; on the other hand, the variation of power is transmitted along the direction of field strength, so the energy flow $\vec{s}_r$ transmitted along the direction of field strength is formed, and its transmission speed can be understood as the speed of light. Therefore, the power-based energy flow is expressed as follows:

$$\vec{s}_u = \vec{u}w = \vec{u}(q\vec{v}\cdot\vec{E})$$
$$\vec{s}_r = \vec{r}\frac{dw}{dt} = (q\vec{v}\cdot\vec{r}\frac{\partial_t Q}{Q} - q\vec{v}\cdot\vec{u} - 3\frac{q\vec{v}\cdot\vec{r}}{r}\partial_t r)\vec{E} \qquad \text{Equation 3}$$

It is clear that the energy flow carried by motion and changing power is kinematic, so the energy received by the stressed object has kinetic energy effect. According to the energy and momentum transfer mechanism, the total energy mc^2 of the stressed object is changed by receiving the energy flow $\vec{s}_u + \vec{s}_r$, and this change is related to the state of motion, so the change effect can be described by introducing acceleration $\vec{a}$, this effect can just be understood as **kinetic force mechanism**, which is specifically expressed as follows according to the law of energy transfer:

$$mc^2\vec{a} = \vec{s}_u + \vec{s}_r = \vec{u}w + \vec{r}(\frac{d}{dt}w) \qquad \text{Equation 4}$$

In the classical mechanics, the expression of force is $\vec{f} = m\vec{a}$, according to which Equation 4 just represents the force effect of energy flow. Here we refer to the corresponding force as kinetic force $\vec{F}$, and express which as follows:

$$mc^2\vec{a} = c^2m\vec{a} = c^2\vec{F} = \vec{u}w + \vec{r}(\frac{d}{dt}w) \Rightarrow \vec{F} = \frac{1}{c^2}[\vec{u}w + \vec{r}(\frac{d}{dt}w)]$$
$$\Rightarrow \vec{F} = \frac{1}{c^2}[\vec{u}(q\vec{v}\cdot\vec{E}) - \vec{E}(q\vec{v}\cdot\vec{u}) + q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}] \qquad \text{Equation 5}$$

2.2. PERFORMANCE ANALYSIS ON KINETIC FORCE

According to the expression of Formula (5), the kinetic force $\vec{F}$ is consisted by three parts, among which the first item $\vec{u}(q\vec{v}\cdot\vec{E})/c^2$ is provided by power flow, the second item $-\vec{E}(q\vec{v}\cdot\vec{u})/c^2$ is provided by power change caused by field strength change based on field source motion. The force effect of these two items is obviously related to the motion speed $\vec{u}$ of the field source, and according to the calculation method of vector cross product, relevant field strength can be introduced to express it. Therefore, the first item and the second item can be combined into dynamic field force $\vec{f}_{\mathrm{d}}$, which is described as follows by introducing dynamic field strength $\vec{D}$:

$$\vec{f}_d = \frac{1}{c^2}[\vec{u}(q\vec{v}\cdot\vec{E}) - \vec{E}(q\vec{v}\cdot\vec{u})] = \frac{1}{c^2}q\vec{v}\times(\vec{u}\times\vec{E})$$
$$\Rightarrow \vec{D} = \frac{1}{c^2}(\vec{u}\times\vec{E}) \Rightarrow \vec{f}_d = q\vec{v}\times\vec{D}$$

Equation 6

In Equation 5 the third item $q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}/c^2$ is obviously caused by the change of field source force charge *Q* and the distance *r* between field strength and field source. According to the characteristics of this item, the corresponding force can be defined as variable field force $\vec{f}_{\mathrm{v}}$, and the variable field strength $\vec{V}$ can be introduced in the expression:

$$\vec{f}_{\mathrm{v}} = \frac{1}{c^2}[q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}] = q\vec{v}\cdot\frac{E}{c^2}(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\frac{\vec{r}}{r}$$
$$\Rightarrow \vec{V} = \frac{E}{c^2}(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r}), \hat{e}_r = \frac{\vec{r}}{r} \Rightarrow \vec{f}_{\mathrm{v}} = q\vec{v}\cdot\vec{V}\hat{e}_r$$

Equation 7

According to the above analysis and expression, there are two forces generated by the flow and variation of power; Obviously, these two forces can be felt only by the moving force charge, because that only the moving force charge can generate power under the action of static force. As the result that in the massless field of motion or change, the moving force charge can feel three forces as a whole, so the total force $\vec{f}_{\mathrm{t}}$ is composed by three forces: static field force $\vec{f}_{\mathrm{s}}$, dynamic field force $\vec{f}_{\mathrm{d}}$ and variable field force $\vec{f}_{\mathrm{v}}$; And the relevant forces are respectively expressed by introducing field strength : static field strength $\vec{E}$, dynamic field strength $\vec{D}$ and variable field strength $\vec{V}$. The specific expression is as follows:

$$\vec{F} = \vec{f}_{\mathrm{d}} + \vec{f}_{\mathrm{v}} = q\vec{v}\times\vec{D} + q\vec{v}\cdot\vec{V}\hat{e}_r$$
$$\vec{f}_{\mathrm{t}} = \vec{f}_{\mathrm{s}} + \vec{F} = \vec{f}_{\mathrm{s}} + \vec{f}_{\mathrm{d}} + \vec{f}_{\mathrm{v}} = q\vec{E} + q\vec{v}\times\vec{D} + q\vec{v}\cdot\vec{V}\hat{e}_r$$

Equation 8

2.3. ANALYSIS AND SUMMARY OF THREE SPECIAL CASES

In order to complete understand the effects of power flow and variation, the following three special situations should be analyzed.

1) **Negative power effect**: If the power of the static field to the stressed object is negative, it indicates that the power is derived from the stressed object. Why does the stressed object still have kinetic force effect in this case? This effect can be explained by the law of conservation of momentum: if the power is negative, the power is transferred to the field source by the stressed object, and the power must flow at the speed of the field source, so the momentum corresponding to this power flow is provided by the stressed object; According to the law of conservation of momentum, when the stressed object transmit some momentum to the outside, the stressed object must receive the momentum effect opposite to the outgoing momentum at the same time, which specifically reflect the relevant force. Therefore, under the negative power effect, the kinetic force accepted by the stressed object is in reverse with the field source velocity, and this physical mechanism is accurately expressed by the kinetic force expression formula:

$$w < 0 \Rightarrow w = -|w| \Rightarrow \vec{F} = \frac{1}{c^2}[-\vec{u}\,|w| + \vec{r}(\frac{d}{dt}w)] = \frac{1}{c^2}[\vec{u}w + \vec{r}(\frac{d}{dt}w)] \quad \text{Equation 9}$$

2) **Summing mechanism of multi field sources**: If the field source is composed by multiple force charges, under the condition that the speed and position of each force charge are strictly understood, the sum of kinetic force and relevant field strength can be achieved, however the force charges and static field strengths cannot be arbitrarily summed; The specific summation calculation must be based on the speed and position of sub charges:

$$\text{Generally: } \vec{f_i} = \frac{1}{c^2}[\vec{u}_i(q\vec{v}\cdot\vec{E}_i) - \vec{E}_i(q\vec{v}\cdot\vec{u}_i) + q\vec{v}\cdot(\vec{r}_i\frac{\partial_t Q_i}{Q_i} - 3\vec{r}_i\frac{\partial_t r_i}{r_i})\vec{E}_i] \Rightarrow \vec{F} = \sum_{i=1}^{N}\vec{f_i}$$

$$\text{In particular: only when all } \vec{u}_i = \vec{u}, \vec{r}_i = \vec{r} \Rightarrow \vec{E} = \sum_{i=1}^{N}\vec{E}_i\,, Q = \sum_{i=1}^{N}Q_i$$

$$\Rightarrow \vec{F} = \sum_{i=1}^{N}\vec{f_i} = \frac{1}{c^2}[\vec{u}(q\vec{v}\cdot\vec{E}) - \vec{E}(q\vec{v}\cdot\vec{u}) + q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}] \quad \text{Equation 10}$$

3) **Conditions for the generation of massless waves**: Under general conditions, the static field is stationary relative to the field source, so there is no wave generated under the ordinary oscillation of the field source. How can massless waves be generated? According to the principle of constant speed of light, it is clear that massless waves must move at the speed of light in vacuum. Therefore, the generation of wave is the effect of static field leaving the field source. The analysis of this problem needs to import the flow and change mechanism of field energy. Namely: the density of field

energy is proportional to the square of field strength, so the field energy flows under the movement of the field source and the change of the field strength; Because the field source have mass, its speed cannot reach the speed of light, so when the flow speed of field energy reaches the speed of light, the field energy will leave the field source and form waves. To achieve that the velocity of field energy reaches the speed of light, it is necessary to implement the state that the field source moves, and the force charge changes, the logic analysis of this mechanism is as follows.

First, according to Equation 1 and Equation 2, the expression of static field energy density w_s and its variation $\partial_t w_s$ can be derived, the energy flow formed by field intensity change is expressed as follows:

$$w_s = \beta E^2, \partial_t w_s = \frac{d}{dt}(\beta E^2) = 2\beta \vec{E} \cdot \partial_t \vec{E} = 2\beta E^2 (\frac{\partial_t Q}{Q} - \frac{\vec{r} \cdot \vec{u}}{r^2} - \frac{3}{r}\partial_t r)$$
$$\Rightarrow \vec{r}\frac{dw_s}{dt} = 2\beta E^2 (\frac{\partial_t Q}{Q} - \frac{\vec{r} \cdot \vec{u}}{r^2} - \frac{3}{r}\partial_t r)\vec{r} = 2w_s (\frac{\partial_t Q}{Q} - \frac{\vec{r} \cdot \vec{u}}{r^2} - \frac{3}{r}\partial_t r)\vec{r} \quad \text{Equation 11}$$

Under the joint action of the motion of the field source and the change of the force charge, the energy flow formed is equal to the field energy w_s moving at speed $\vec{v}$, so the relationship is expressed as follows：

$$\vec{v}w_s = \vec{u}w_s + \vec{r}\frac{dw_s}{dt} = \vec{u}w_s + 2w_s(\frac{\partial_t Q}{Q} - \frac{\vec{r} \cdot \vec{u}}{r^2} - \frac{3}{r}\partial_t r)\vec{r}$$
$$\Rightarrow \vec{v} = \vec{u} + 2(\frac{\partial_t Q}{Q} - \frac{\vec{r} \cdot \vec{u}}{r^2} - \frac{3}{r}\partial_t r)\vec{r} \quad \text{Equation 12}$$

In general, the speed of field energy density is less than the speed of light, namely $v < c$; If the speed of field energy flow reaches the speed of light, the corresponding field will form the wave state. Based on the above analysis, it can be inferred the field source conditions under which field energy reaching the speed of light:

$$\text{let}: \vec{r} \cdot \vec{u} = ru\cos\theta, \vec{v} = \vec{c} \Rightarrow \vec{c} = \vec{u} + 2(\frac{\partial_t Q}{Q} - \frac{u\cos\theta}{r} - \frac{3}{r}\partial_t r)\vec{r}$$
$$\Rightarrow c^2 = u^2 + 4(\frac{\partial_t Q}{Q}r - u\cos\theta - 3\partial_t r)u\cos\theta + 4(\frac{\partial_t Q}{Q}r - u\cos\theta - 3\partial_t r)^2$$
$$\Rightarrow u = x\cos\theta \pm \sqrt{c^2 - x^2\sin^2\theta}, x = 2(\frac{\partial_t Q}{Q}r - 3\partial_t r) \quad \text{Equation 13}$$

It is clear that this speed $\vec{u}$ is the motion speed of the field source, so it must be less than the speed of light. Therefore, according to the derivation of Equation 13, when the field source velocity satisfies the expression of the above formula and its value is less than the speed of light, the condition for the field energy to move at the speed of light is just reached, thus forming massless wave. In essence, it can be better understood that the common contribution to the formation of massless waves is the movement of field sources and the change of force charges, verifies are as follows：

$$\text{if: } x = 0 \Rightarrow u = c, v \neq c; \quad \text{if: } \theta = \frac{\pi}{2} \Rightarrow u = \sqrt{c^2 - 4x^2} < c, v = c$$
$$\text{if: } x < 0, \theta = 0 \Rightarrow u = 2x + \sqrt{c^2} < c, v = c; u = 2x - \sqrt{c^2} < -c, v \neq c \quad \text{Equation 14}$$

3. ESSENTIALLY EXPLAIN THE MAGNETIC EFFECT OF ELECTRIC FIELD

3.1. EXPLAIN THE GENERATION MECHANISM OF MAGNETIC FORCE

According to the above analysis on force effect mechanism of dynamic and variable power, we can just deduce the magnetic effect of electrostatic field under the motion and change. In the analysis of electromagnetic field, Q and q is respectively expressed as the electric charge quantity of the electric field source and stressed object, electrostatic field strength is $\vec{E}_e$, and $K = 1/4\pi\varepsilon_0$; When these expressions are introduced into Equation 1 and Equation 2 in turn, specific analysis on motion and changing electric field can be obtained:

$$\vec{E}_e = \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}, \partial_t\vec{E}_e = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^3}(\vec{r}\frac{\partial_t Q}{Q} - \vec{u} - \frac{3\vec{r}}{r}\partial_t r), \vec{f}_{se} = \frac{qQ}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}$$
$$w = \vec{f}_{se} \cdot \vec{v} = q\vec{v} \cdot \vec{E}_e, \frac{dw}{dt} = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^3}(q\vec{v} \cdot \vec{r}\frac{\partial_t Q}{Q} - q\vec{v} \cdot \vec{u} - 3\frac{q\vec{v}\cdot\vec{r}}{r}\partial_t r) \quad \text{Equation 15}$$

Introduce the results of Equation 15 into Equation 3, Equation 4 and Equation 5 in turn, can obtain the expression of the kinetic force $\vec{F}_e$ about the electric field:

$$\vec{F}_e = \frac{1}{c^2}[\vec{u}(q\vec{v} \cdot \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}) - \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}(q\vec{v} \cdot \vec{u}) + q\vec{v} \cdot (\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}]$$
$$= \frac{1}{c^2}[\vec{u}(q\vec{v} \cdot \vec{E}_e) - \vec{E}_e(q\vec{v} \cdot \vec{u}) + q\vec{v} \cdot (\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}_e] \quad \text{Equation 16}$$

According to Equation 6, the dynamic field force in Equation 16 can be expressed as $\vec{f}_d = q\vec{v} \times \vec{D}$, this expression is very similar to Lorentz force, so magnetic force $\vec{f}_m$ and magnetic induction intensity $\vec{B}$ are introduced in the following formulas:

$$\frac{1}{c^2}[\vec{u}(q\vec{v} \cdot \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}) - \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}(q\vec{v} \cdot \vec{u}) = \frac{1}{c^2}q\vec{v} \times (\vec{u} \times \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}) = q\vec{v} \times \frac{1}{c^2}(\vec{u} \times \vec{E}_e)$$
$$\Rightarrow \vec{B} = \frac{1}{c^2}(\vec{u} \times \vec{E}_e) = \varepsilon_0\mu_0(\vec{u} \times \frac{Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}) = \frac{\mu_0}{4\pi}\frac{Q\vec{u}\times\vec{r}}{r^3}, \vec{f}_m = \frac{1}{c^2}q\vec{v} \times (\vec{u} \times \vec{E}_e) = q\vec{v} \times \vec{B} \quad \text{Equation 17}$$

It is clear that the magnetic force $\vec{f}_m$ just is dynamic field force $\vec{f}_d$, so the nature of magnetism can be explained: Under the condition of movement and intensity change of electrostatic field, the power received by the moving force charge has flowing and changing states, so the power flow transfer to the stressed object in the form of kinetic energy; As the result, the stressed object feel the dynamic force effect, which is exactly expressed by the magnetic force in classical physics.

Similarly, the expression of magnetic field is exactly consistent with the classical electromagnetics, and the magnetic field expression of the moving charge in Equation 17 can also be extended to the magnetic field expression of the current, thus Biot-Savart law can be derived: for a current element $Id\vec{l}$, its value can be described by the amount of charge and the speed of motion, namely $Id\vec{l} = \vec{u}dQ$; By introducing it into Equation 17, the magnetic induction field of current element is expressed as follows:

$$d\vec{B} = \frac{\mu_0}{4\pi}\frac{dQ\vec{u}\times\vec{r}}{r^3} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\vec{r}}{r^3} \qquad \text{Equation 18}$$

3.2. ANALYZE THE POSSIBLE EFFECT OF VARIABLE FIELD FORCE IN ELECTRICITY

In Equation 16, the variable field force $\vec{f}_{\text{ve}}$ can be derived according to Equation 7:

$$\frac{1}{c^2}q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}_e = q\vec{v}\cdot\vec{r}(\frac{\partial_t Q}{Q} - 3\frac{\partial_t r}{r})\frac{\varepsilon_0\mu_0 Q}{4\pi\varepsilon_0}\frac{\vec{r}}{r^3}$$

$$= q\vec{v}\cdot\vec{r}(\frac{\partial_t Q}{Q} - 3\frac{\partial_t r}{r})\frac{\mu_0 Q}{4\pi r^2}\frac{\vec{r}}{r}$$

$$\Rightarrow \vec{V}_e = \frac{\vec{E}_e}{c^2}(r\frac{\partial_t Q}{Q} - 3\partial_t r) = (\frac{\partial_t Q}{Q} - 3\frac{\partial_t r}{r})\frac{\mu_0 Q\vec{r}}{4\pi r^2}, \hat{e}_r = \frac{\vec{r}}{r} \Rightarrow \vec{f}_{\text{ve}} = q\vec{v}\cdot\vec{V}_e\hat{e}_r \qquad \text{Equation 19}$$

Obviously, the variable field force $\vec{f}_{\text{ve}}$ in electricity is caused by the charge change and position shift of the field source, its direction is parallel to the direction of electrostatic field, which is reasonable and effective; however, the effect of this force has not been proposed in classical electromagnetics. Whether the force $\vec{f}_{\text{ve}}$ really exists needs to be verified by experiments, the effects of this force can theoretically explain some abnormal electromagnetic phenomena.

Under special conditions, when the field source stops moving and the charge increases or decreases, it can be deduced that the magnetic effect is zero; However, the total force $\vec{f}_{\text{te}}$ accepted by the moving stressed object in the electric field is parallel to the static force $\vec{f}_{\text{se}}$, but the value is not equal, why? This phenomenon can be explained according to the effect of variable field force: Under this condition, the magnetic force is zero, the variable field force is not zero, so the total force on the moving stressed object is the sum of static force and variable field force:

$$\text{when: } \vec{u} = 0, \partial_t r = 0, \partial_t Q \neq 0 \Rightarrow \vec{f}_{\text{se}} = q\vec{E}_e, \vec{f}_m = 0, \vec{f}_{\text{ve}} = \frac{1}{c^2}[q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q})\vec{E}_e]$$

$$\Rightarrow \vec{f}_{\text{te}} = \vec{f}_{\text{se}} + \vec{f}_m + \vec{f}_{\text{ve}} = q\vec{E}_e + \frac{1}{c^2}[q\vec{v}\cdot(\vec{r}\frac{\partial_t Q}{Q})\vec{E}_e] \neq \vec{f}_{\text{se}} \qquad \text{Equation 20}$$

Under general conditions, there is no change in the amount of field source charge, only movement, the dynamic field force is relatively large, the variable field force is small, so the force effect in electricity is magnetic force (dynamic field force), variable field force and electrostatic force, however the variable field force is not obvious, the example is as follows:

$$\text{when: } \vec{u} \neq 0, \partial_t Q = 0 \Rightarrow \vec{F}_e = \frac{1}{c^2}[\vec{u}(q\vec{v} \cdot \vec{E}_e) - \vec{E}_e(q\vec{v} \cdot \vec{u}) - q\vec{v} \cdot (3\vec{r}\frac{\partial_t r}{r})\vec{E}_e]$$

$$\Rightarrow \vec{F}_e = q\vec{v} \times \frac{1}{c^2}(\vec{u} \times \vec{E}_e) - q\vec{v} \cdot \frac{1}{c^2}(3\vec{r}\frac{\partial_t r}{r})\vec{E}_e, \vec{f}_{\text{ve}} = -q\vec{v} \cdot \frac{1}{c^2}(3\vec{r}\frac{\partial_t r}{r})\vec{E}_e \quad \text{Equation 21}$$

3.3. EXPLANATION OF SOME SPECIAL ELECTROMAGNETIC PHENOMENA

Based on the mechanism of power flow and change, three strange electromagnetic phenomena can be explained.

1) **Why do some places have magnetic field strength but no electric field strength**? According to the theory in this paper, this phenomenon can be clearly explained: The field source is composed of some positive and negative charges Q_i, and the sum of the charges is zero; The positions of these charges are approximately the same relative to the target position; However these charges move at different speeds $\vec{u}_i$, so the expression of electric field and magnetic field strength correlated with field source state can be deduced according to Equation 10 and Equation 17, which can be clearly seen that there may be electromagnetic phenomena where the static field is zero however the magnetic field is not zero.

$$Q_i \neq 0, Q = \sum Q_i = 0, \vec{u}_i \neq \vec{u}_j, \vec{r}_i \doteq \vec{r}_j \Rightarrow \vec{E}_e = \sum \frac{Q_i}{4\pi\varepsilon_0}\frac{\vec{r}_i}{{r_i}^3} \doteq \frac{1}{4\pi\varepsilon_0}\frac{\vec{r}_i}{{r_i}^3}\sum Q_i = 0$$

$$\Rightarrow \vec{B}_i = \frac{1}{c^2}(\vec{u}_i \times \vec{E}_{ei}) \Rightarrow \vec{B} = \sum \vec{B}_i = \frac{1}{c^2}\sum(\vec{u}_i \times \vec{E}_{ei}) = \frac{1}{c^2}\sum(\vec{u}_i \times \frac{Q_i}{4\pi\varepsilon_0}\frac{\vec{r}_i}{{r_i}^3}) \neq 0$$

Equation 22

2) **Why do the same kind of electric charges moving in parallel in the same direction attract each other**? About this typical case: Two positive charges are repulsive to each other under static state; However, when they move in parallel in the same direction, they will be attractive to each other. This phenomenon has been described in classical electromagnetics, and its essential cause can be clearly analyzed according to Equation 16, Equation 17 and Equation 19: Under this special condition, the variation of power provides energy flow to the stressed object, and the direction of energy flow is opposite to that of electrostatic force, so the corresponding magnetic force is just opposite to that of electrostatic force, the description is as follows:

$$\text{set up: } \vec{u} \parallel \vec{v}, \vec{v} \cdot \vec{u} > 0, \vec{v} \perp \vec{E}_e, \vec{f}_{\text{se}} = q\vec{E}_e \Rightarrow \vec{v} \cdot \vec{r} = 0$$

$$\Rightarrow \vec{F}_e = \frac{1}{c^2}[\vec{u}(q\vec{v} \cdot \vec{E}_e) - \vec{E}_e(q\vec{v} \cdot \vec{u}) + q\vec{v} \cdot (\vec{r}\frac{\partial_t Q}{Q} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}_e] = -\frac{(\vec{v} \cdot \vec{u})}{c^2}q\vec{E}_e = \vec{f}_m + \vec{f}_{\text{ve}}$$

$$\Rightarrow \vec{f}_{\text{ve}} = 0, \vec{f}_m = -\frac{(\vec{v} \cdot \vec{u})}{c^2}q\vec{E}_e = -\frac{(\vec{v} \cdot \vec{u})}{c^2}\vec{f}_{\text{se}} \quad \text{Equation 23}$$

3) **What are the conditions and mechanisms of electromagnetic wave excitation**? We can know the generation conditions of electromagnetic waves and photons. It shows that under the condition of motion and charge change of the field source, if the electric field energy moves at the speed of light, the electric field will leave the field source and form electromagnetic waves. Under electromagnetic wave state, the electric field moves at the speed of light, and the corresponding dynamic field (magnetic field) will also form. The generation mechanism of the massless waves has been analyzed in Equation 11, Equation 12, Equation 13 and Equation 14, here the electromagnetic wave is specifically analyzed, assume that: The motion speed of the field source is $\vec{u}$, which must be less than the speed c of light; The flow velocity of field energy is $\vec{v}$, which is equal to the speed of light under the condition of forming electromagnetic waves; The charge change $\partial_t Q$ of field source also need to exist. Based on the Equation 11, Equation 12, Equation 13 and Equation 14, according to the electromagnetic wave generation mechanism, these three physical quantities must meet this condition: $v = c, c > u = x\cos\theta \pm \sqrt{c^2 - x^2 \sin^2\theta}, x = 2(r\partial_t Q / Q - 3\partial_t r)$, it is clear that the generation of electromagnetic wave is jointly affected by the field source velocity, the change rate of field charge, the angle between field source velocity and field strength.

Furthermore, according to the analysis of the magnetic field mechanism in Equation 17, the relationship between the electric field strength E_e and the magnetic field strength H of the electromagnetic wave can also be deduced, which is exactly consistent with the classical electromagnetics:

$$\vec{c} \perp \vec{E}_e \Rightarrow \vec{B} = \frac{1}{c^2}(\vec{c} \times \vec{E}_e) = \frac{1}{c^2}(cE_e\hat{e}_B) = \sqrt{\varepsilon_0\mu_0}E_e\hat{e}_B$$

$$\Rightarrow H = \frac{B}{\mu_0} = \frac{\sqrt{\varepsilon_0\mu_0}E_e}{\mu_0} \Rightarrow \sqrt{\varepsilon_0}E_e = \sqrt{\mu_0}H \qquad \text{Equation 24}$$

3.4. SUMMARY OF ELECTROMAGNETIC EFFECTS

The phenomenon analysis and law description of classical electromagnetics are very reasonable, but it cannot explain why the magnetic phenomenon occurs in the motion state of electric field. The kinetic force mechanism of power flow and variation proposed in this paper can explain the essence of magnetic force.

In a word, under the condition of movement and change of electrostatic field, the moving stressed object receives power with flowing and changing states, according to the transmission mechanism of energy and momentum, these flowing and changing power make the stressed object accept the corresponding energy flow effects. These effects are exactly consistent with the classical magnetic effect, so it can be fundamentally understood that the essence of magnetic force is the flow and variation effect of power. At the same time, the introduction of variable field force can explain some electric field effects that cannot be explained by electrostatic force and magnetic force.

4. PREDICTION OF THE KINETIC FORCE EFFECT FOR GRAVITATIONAL FIELD

What are the kinetic force effects of moving and changing gravitational fields? Here based on the flow and variation mechanism of power to analyze this problem. For gravitational field, which is massless field, the force charge of the field source is the mass, and the expression of gravitational field is also an inverse square formula according to Newton's law, so the relevant physical quantities are firstly introduced in this following formula:

$$Q = M, q = m, K = G \Rightarrow \vec{E}_g = GM\frac{\vec{r}}{r^3}, \vec{f}_{\text{sg}} = m\vec{E}_g, w = \vec{f}_{\text{sg}} \cdot \vec{v} = m\vec{v} \cdot \vec{E}_g$$

Equation 25

At the prompt of formula (25), according to Formulas (1), (2), (3), (4) and (5), the kinetic force of gravitational field is expressed as follows:

$$\vec{F}_g = \frac{1}{c^2}[\vec{u}(m\vec{v} \cdot \vec{E}_g) - \vec{E}_g(m\vec{v} \cdot \vec{u}) + m\vec{v} \cdot (\vec{r}\frac{\partial_t M}{M} - 3\vec{r}\frac{\partial_t r}{r})\vec{E}_g]$$

Equation 26

The kinetic force of gravitational field also can be classified into two types: dynamic field force $\vec{f}_{\text{dg}}$ and variable field force $\vec{f}_{\text{vg}}$; The corresponding dynamic field strength $\vec{D}_{\text{g}}$ and variable field strength $\vec{V}_{\text{g}}$ can also be introduced. The specific expression is as follow according to Equation 6, Equation 7 and Equation 8:

$$\vec{D}_g = \frac{1}{c^2}(\vec{u} \times \vec{E}_g), \vec{V}_g = \frac{E_g}{c^2}(\vec{r}\frac{\partial_t M}{M} - 3\vec{r}\frac{\partial_t r}{r}) \Rightarrow \vec{f}_{\text{dg}} = m\vec{v} \times \vec{D}_g, \vec{f}_{\text{vg}} = m\vec{v} \cdot \vec{V}_g \hat{e}_r$$
$$\Rightarrow F_g = \vec{f}_{\text{dg}} + \vec{f}_{\text{vg}}, \quad \vec{f}_{\text{tg}} = \vec{f}_{\text{sg}} + \vec{f}_{\text{dg}} + \vec{f}_{\text{vg}} = m\vec{E}_g + m\vec{v} \times \vec{D}_g + m\vec{v} \cdot \vec{V}_g \hat{e}_r$$

Equation 27

For the gravitational field, this theory clearly deduces the possibility of the existence of dynamic field force and variable field force; However, whether it really exists remains to be verified by experiments. According to the characteristics of gravity, the velocity of stars in the universe is relatively small, so the dynamic field force effect is not obvious; However, the mass change rate of some stars is relatively large, in this case the effect of variable field force is relatively large. Based on the analysis of this mechanism, the effects can be summarized as follows: When the gravitational field source is static and the force charge does not change, Newton's law can individually express gravitational force; However when the field source has motion and the field charge has change, it is necessary to express static field force based on Newton's law, and at the same time introduce dynamic field force and variable field force based on the kinetic force mechanism.

Can gravitational waves really exist? The analysis of gravitational waves is similar to that of electromagnetic waves, so the generating conditions of gravitational waves are expressed as follows: $v = c, c > u = x\cos\theta \pm \sqrt{c^2 - x^2\sin^2\theta}, x = 2(r\partial_t M / M - 3\partial_t r)$. Under this condition, the gravitational wave can be really generated, and the light speed movement of the gravitational field will also produce the dynamic field effects, for which the dynamic field strength $\vec{D}_g$ of gravitational wave can be introduced:

$$\vec{c} \perp \vec{E}_g \Rightarrow \vec{D}_g = \frac{1}{c^2}(\vec{c} \times \vec{E}_g) = \frac{1}{c^2}(cE_g\hat{e}_D) = \sqrt{\varepsilon_0\mu_0}E_g\hat{e}_D$$
$$\Rightarrow D_g = \sqrt{\varepsilon_0\mu_0}E_g \Rightarrow cD_g = E_g \quad \text{Equation 28}$$

Gravitational waves can be deduced theoretically, but it is obvious that the formation of gravitational waves is relatively rare in concrete implementation. Because that the objects with strong gravity move at low speeds, so the generating conditions of gravitational waves are difficult to achieve. Whether this prediction is correct remains to be verified by experiments.

5. SUMMARY

In conclusion, firstly the kinetic force mechanism based on the flow and variation effects of power is proposed and analyzed, then the magnetic effect of electric field is essentially explained according to the kinetic force mechanism, further the possible kinetic force effect of the gravitational field under the conditions of motion and change is predicted. The explanation on electromagnetic phenomena just proves the correctness of the kinetic force mechanism, the prediction of kinetic force effects for gravitational fields just indicates the application value of the kinetic force mechanism. According to the principle of scientific research, the kinetic force mechanism and the related theories need further thinking and experimental verification.

CONFLICT OF INTERESTS

None.

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