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An interesting model of electron

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Abstract

According to the photon model of the Theory of System Relativity, the author constructs an electronic model, which expounds the origin of mass, vortex-flux nature of the charge and mass, the nature of electric field and the nature of current magnetic effect. Then it is concluded that the spiral motion of free electrons on the surface of the wire is the phenomenon of room-temperature superconductivity.

Keywords: electron model, neutral field, polar field, the origin of mass, vortex-flux, electron pairs, intrinsic electric field, covariant electric field, room-temperature superconductivity.

1. Introduction

In modern physics, it is believed that the electron is a stable elementary particle with a negative charge. However, there is no reasonable explanation for why an electron has both mass and charge.

2. Hint of the structure of the electron

In electromagnetism, we typically view the electron as a small charged sphere with a uniform charge distribution, as shown in Figure 1. This classical small-sphere model of the electron cannot reasonably explain why the electron has mass or why the electron has a spin of 1/2. Apparently, this model is too crude. By carefully observing some features of the electron, we can acquire information concerning the structure of the electron.

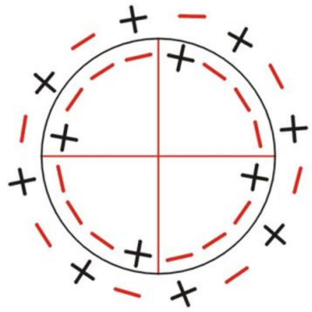

Figure 1 Small-sphere model of the electron

In particle physics, it is believed that the spin quantum number of the electron, which is the quantum number that characterizes the spin angular momentum of the electron, is s=1/2. Studies of particle physics have indicated that spin and the symmetry of spatial rotation are related. In the Theory of System Relativity[1], it is proposed that the so-called spin is the self-rotation of a particle and that the so-called spin quantum number is a description of the structural symmetry of the particle field in the rotational state.

In the microscopic environment, each particle is always rotating. For particles with a spin of 1 (such as the photon), the fields of these particles appear identical after a full rotation; for particles with a spin of 1/2 (such as the electron and the proton), the fields of these particles appear identical after half of a rotation; for particles with a spin of 0 (such as normal celestial bodies), the fields of these particles appear to be the same from any angle, namely, these particles possess isotropic symmetry.

The spin quantum number of the electron is 1/2, namely, when an electron undergoes half a rotation, it will appear to regain its original orientation. If we combine our knowledge of the magnetic moment of the electron and the properties of macroscopic magnets, the electron can be considered as a combination of four triangular magnets, as shown in Figure 2. Then, when this combination of magnets is rotated through 180°, we will see another magnetic face with the same polarity as in the original orientation. Hence, from the spin quantum number of the electron, we infer that the electron might possess four pole faces.

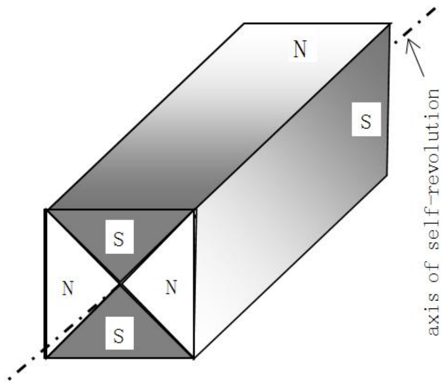

Figure 2 Magnet model of the electron

The electron has both charge and mass, which are essentially measures of the particle's interaction with the Coulomb force and universal gravity, respectively. These two forces with their different properties reflect that the electron possesses two fields with different properties. Therefore, the electron simultaneously possesses two types of fields that can be characterized by the properties of mass and charge.

3. Rectangular model of the electron

As mentioned above, the electron model in the Theory of System Relativity is as follows:

The electron is a nearly rectangular stable-state particle composed of a number of photons[2], as shown in Figure 3a. The photons in the electron are arrayed in a symmetric diamond arrangement. Adjacent photons are opposite in polarity, and the coupled vortex rings (neutral field lines) between the photons bind them tightly together. The number of layers of photons is a multiple of 2. Figure 3b shows the symmetric square end face of an electron consisting of eight layers of photons.

Similar to the photon, from inside to outside, the field of the electron is also divided into a three-layer structure with an internal field, a critical field, and an external field, as shown in Figure 3c. The domain enclosed by the envelopes of the independent field lines of the photons in the electron is called the internal field of the electron; it is also referred to as the noumenon of the electron.

Outside the interior field of the electron, the region enclosed by the radius r_0 is called the critical field of the electron and is also known as the **electron body**; correspondingly, the outer boundary of this critical field is called the surface of the electron, and the radius r_0 of the critical field is called the radius of the electron.

Outside the electron, the attenuation step size of the field strength is a constant r_0, and this domain is called the external field of the electron; it is also referred to as the **electron field**. As shown in Figure 3c, the electron field is composed of a neutral field and a polar field; this structure provides the explanation for the origins of the charge and mass of the electron. That is, the neutral field of the electron determines the mass property, and the polar field determines the charge property.

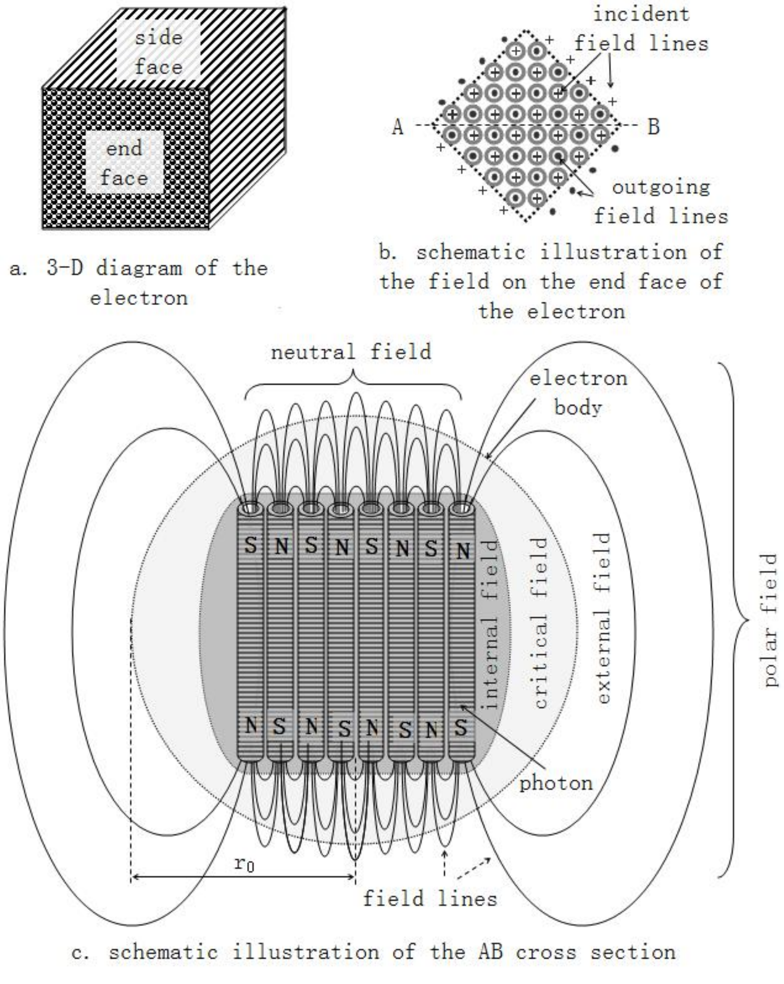

Figure 3 Structure and field of the electron

As shown in Figure 3c, the field of the electron on its two end faces belongs to the neutral field; the field on the four lateral sides is the polar field, which possesses the same polarity on two opposing sides and opposite polarities on two adjacent sides. The four sides of the electron are analogous to four bar magnets. When the electron is viewed from either end face, the polarity is the same on two opposing sides and opposite on two adjacent sides; this type of field is called a **quadrupole field**. The polar field of the proton field is also a quadrupole field. Therefore, similar to the proton, the electron also has an electric quadrupole moment.

4. The origin of mass and vortex-flux nature of the charge and mass of electrons

4.1. The origin of mass

The question of the origin of mass is a fundamental question about the origin of the world. Recently, the scientific community has been generally optimistic about the Higgs mechanism and has committed to a search for the Higgs boson. In experiments at the Large Hadron Collider, the European Center for Nuclear Research (CERN) recently "discovered" a particle that is suspected to be the Higgs boson; they issued a statement on July 4, 2012 that "the newly discovered particle is consistent with the long-sought Higgs boson." As a result, Belgian physicist Francois Englert and British physicist Peter Higgs shared the 2013 Nobel Prize in Physics.

Many people have expressed doubts regarding this discovery. The Chinese-American Prof. Cao Zhang has noted on his blog that "In March 2013, after some discussion, the scientists at CERN 'verified' that this suspected particle is the Higgs boson with no further understanding of the physical properties of the suspected Higgs boson. There is only one large laboratory like CERN in the world. Therefore, when these CERN scientists say ‘verified,’ other people have no sufficient reason to deny it."

As for a Higgs boson with a spin of 0, a spin of 0 means that this particle should look the same from any angle, which means that the external field of the particle is an isotropic neutral field (monopole field). According to the particle model of the Theory of System Relativity, with the exception of the photon, the fields of all microscopic particles are composite fields consisting of polar fields and neutral fields. Only for micro-particles above the molecular level can their neutral fields shield the polar fields of their interior particles such that they exhibit the features of an isotropic monopole field. This concept is consistent with the later deduction that "the mass of the Higgs boson must be very large." However, such a micro-particle with a spin of 0 and above the molecular level is clearly not consistent with the Higgs boson. Therefore, the Higgs boson does not exist, and there must be some other origin of mass.

Matter with mass is primarily composed of particles such as protons, neutrons, and electrons. Therefore, a discussion of the origin of mass is essentially a discussion of the origin of the masses of these particles.

In the Theory of System Relativity, it is believed that when particles with purely polar fields (such as photons) are oriented in parallel and opposite directions and condense into composite-field particles with polar fields and neutral fields, mass will be generated. That is, mass originates from the generation of the neutral field.

As an example, the structure and field of the electron are depicted in Figure 3c. When many photons are arranged in parallel and condense into an electron, on the two end faces of the electron, adjacent photons are opposite in polarity and are mutually coupled; their coupled field lines extend outward radially. These radial field lines are uniformly distributed on the end face of the electron. This field structure is completely different from that of a polar field. In the Theory of System Relativity, such a field is called a neutral field; by contrast, the field on the four side surfaces of the electron is the polar field of the surface photons. The neutral field on the end faces exhibits the mass property of the electron, and the polar field on the side faces exhibits the so-called electric property of the electron.

It is worth mentioning that the photon is a type of particle with a purely polar field, meaning it does not have a neutral field. Therefore, the photon does not have mass. The macroscopic property exhibited by the photon field is called energy, namely.

4.2. Vortex-flux nature of the charge and mass of electrons

According to the electron model presented in section 3, the electron field is a composite field consisting of a polar field and a neutral field, which is why the electron possesses both mass and electricity.

Let the surface vortex flux of the electron be Φ_0. Specifically, that of the polar vortex flux is Φ_P, and that of the neutral vortex flux is Φ_m. We can then write

$$\Phi_0 = \Phi_P + \Phi_m \quad (1)$$

Because vortex flux and energy are equivalent, let the energy of the electron be E_0; then, we obtain

$$E_0 = \Phi_0 = \Phi_P + \Phi_m \quad (2)$$

The electric charge of the electron, e, is equivalent to Φ_P; The mass of the electron, m_e, is equivalent to Φ_m. It is not difficult to find that the charge and mass of the electron are essentially the vortex fluxes of the electron and reflect the different properties of the vorticity fields.

Nevertheless, mass is the description of the neutral vortex flux on the surface of an object, and charge is the description of the polar vortex flux of an object or particle; a neutral field is a polar coupling field. Hence, mass and charge are unified, and their essence is the vortex flux of the shuon field [1].

5. Nature of electricity

5.1. Generation of an electrostatic field

There is a critical field on the surface of every object. In the critical field on the surface of a metal, there is a distribution of many electrons in free motion, which are usually called **free electrons,** as shown in Figure 4a.

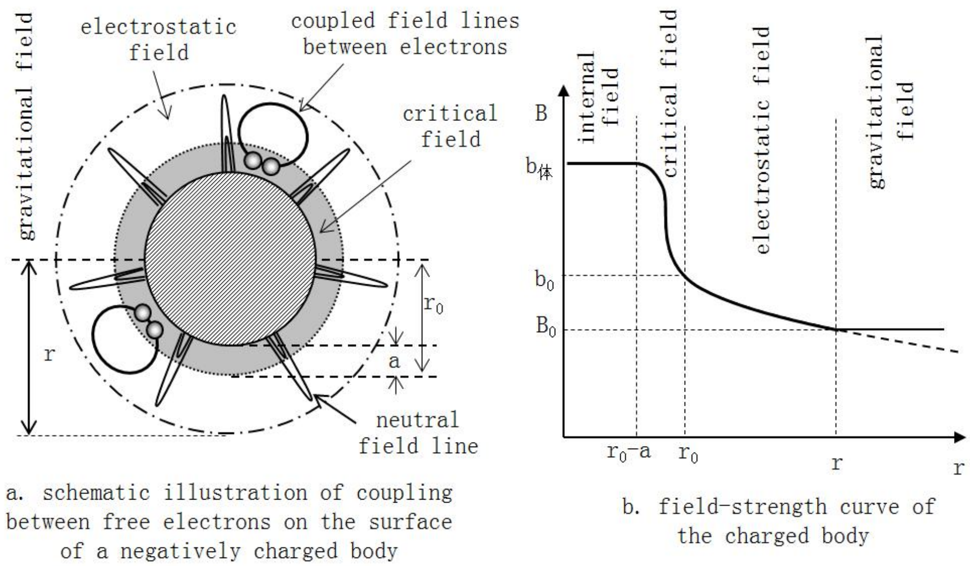

Figure 4 Field structure of a charged body

These free electrons (as well as photons and neutrinos) are coupled to the polar vortex flux emitted by the particles in the object and therefore play a role in screening the polar vortex flux emitted by the object. When the surface density of free electrons in the critical field (i.e., the **electron density**) ρ_e reaches a certain value, the free electrons completely screen the polar vortex flux radiated by the particles on the surface of the object, and such an object is usually called an electrically neutral body. For an electrically neutral body of a known material, the electron density ρ_e in the critical field is a constant.

When an electrically neutral body gains a certain number of electrons, the electron density ρ_e in the critical field increases, and mutual coupling occurs between electrons to form **electron pairs** or even **electron chains** (three or more electrons coupled in series). The electron pair mentioned here is the Cooper pair proposed by L. N. Cooper in 1956. The coupled polar field of such electron pairs and electron chains disperses throughout the space surrounding the object. This type of object is defined as an object carrying a negative charge, as shown in Figure 4. We can see that the essence of the negative electric field is the field formed by the polar vortex flux of free electrons in the critical field of the charged body.

Similarly, if an electrically neutral body loses a certain number of free electrons, the electron density ρ_e in the critical field decreases, and the coupled polar field of the surface nuclei of the object overflows the critical field and disperses throughout the space surrounding the object. This type of object is defined as an object carrying a positive charge. The smaller the electron density ρ_e in the critical field is, the larger the field strength of the positive electric field. Therefore, the essence of the positive electric field is the field formed by the polar vortex flux of the surface atomic nuclei of the charged body.

5.2. Intrinsic electric fields, covariant electric fields, and their interactions

5.2.1. Intrinsic electric fields and covariant electric fields

A charged body is a parallel system composed of particles. A positive electric field of an object is formed by the polar coupling field between nuclei inside the object. The motion state of the nuclei depends on the cyclic interaction between adjacent atoms (or molecules) and is not related to the external environment. Therefore, the field function of the positive electric field, $B_p(t)$, has intrinsic property, namely, a positive electric field is an intrinsic electric field.

A negative electric field of an object is formed by the polar coupling field between free electrons in the critical field of the object. On the one hand, there is interaction between the free electrons and the atoms or molecules inside the object; on the other hand, there is interaction between the polar vortex flux overflowing from the free electrons and the external environment. The motion of free electrons can be easily affected by the external environment. Therefore, the field function of a negative electric field, $B_e(t)$, is covariant, namely, a negative electric field is a covariant electric field.

5.2.2. Interaction between electric fields

The mutual attraction between a positively charged body and a negatively charged body is normally described by the statement that opposites attract. When there is a common boundary of field domains between a positive electric field and a negative electric field, according to the principle of maximum action[1], because the free electrons on the negatively charged body have sufficient degrees of freedom, the motion state of the free electrons will change covariantly under the influence of the positive electric field. This covariant change allows the function of the negative electric field and the function of the positive electric field to completely match and generates a saturated coupling force between the two fields. This type of interaction mechanism is the **principle that opposites attract**.

There is mutually repulsive action between positively charged bodies or between negatively charged bodies, which is normally described by the statement that likes repel. For two positively charged bodies, their field functions are intrinsic functions and cannot mutually change covariantly. Because their field functions are different, they exhibit mutual repulsion. For two negatively charged bodies, although their field functions are both covariant fields, they cannot establish a state of matching because of the randomness of their field functions; therefore, they also exhibit mutual repulsion. This type of interaction mechanism is the **principle that likes repel**.

5.3. Unity of positive and negative electricity and its relationship with quantum theory

5.3.1. Unity of positive and negative electricity

In 1956, L. N. Cooper proved theoretically that for two electrons near the Fermi surface, if and only if there is net attraction, regardless of the strength of the attraction, the two electrons can form a bound state, namely, a Cooper pair. The following year, J. Bardeen, L. N. Cooper, and J. R. Schrieffer established the complete microscopic theory of superconductivity, i.e., BCS theory. BCS theory is the classical theory that interprets superconductivity based on the interaction of electrons and phonons.

Although the Theory of System Relativity does not agree with the interpretation of BCS theory, the existence of electron pairs is an indisputable fact. This fact indicates that there is some attraction phenomenon between electrons. Therefore, the concept that likes repel is not fully correct. As mentioned above, the difference between positive and negative electric fields is that if the sources of the field are different, the intrinsic properties of the field are different. The essence of both positive and negative electric fields is that of a polar field, and they are unified.

5.3.2. Relationship between electric properties and quantum theory

Positive charge and negative charge are concepts that have been established based on the phenomena observed for macroscopic charged bodies that like electric charges repel each other and unlike electric charges attract each other. Therefore, the applicable range of the concepts of positive charge and negative charge is that of a macroscopic charged body. The validity of the direct application of the concept of positive and negative charge in the microscopic regime is questionable.

During the early development of quantum theory, in the Bohr model, N. Bohr was obliged to invoke the concept of "electrons traveling in quantized orbits" to explain the stability of the atom. The essence of the Bohr model is that we must abandon the so-called "theory of electromagnetic radiation," which is apparently revolutionary. However, at that time, N. Bohr could not acknowledge this consequence of his model. Instead, he always attempted to reconcile quantization with electromagnetic theory. These efforts were eventually reflected in Bohr's correspondence principle and the complementarity principle. Therefore, the revolution of N. Bohr remained incomplete (because he retained the concepts of positive and negative charge).

The concepts of positive and negative charge are so entrenched in our thinking that the quark model was constructed based on positive and negative charge. In the quark model, charge is fractionalized. The concept of asymptotic freedom is undoubtedly correct. However, if we use the concept of asymptotic freedom to explain the confinement of quarks, then quarks can exist only in theory and cannot be discovered through experiment. How, then, can it be verified that the quark indeed exists?

The Standard Model of quantum theory is also a theory based on the concept of positive and negative charge. The fact that the strong nuclear force is independent of charge indicates that it is not necessary to endow the quark with fractionized charge. Therefore, the correctness of the Standard Model is also called into question.

6. Nature of the magnetic effect of an electric current

6.1. A complementary experiment concerning the magnetic effect of an electric current

In the famous Oster experiment, a conducting wire is placed in the north-south direction (namely, parallel to the geomagnetic field lines); under the conducting wire, there is a magnetic needle that can freely rotate in the horizontal plane. When there is no current flowing through the conducting wire, the magnetic needle points in the south-north direction because of the geomagnetic field. When there is a current in the conducting wire, the magnetic needle will be deflected. We have read many materials that describe the Oster experiment and have not found any experiments in which the conducting wire has been placed in the east-west direction. It is unknown whether Oster performed such an east-west experiment. In the following, let us conduct this experiment.

We adjust a grid plate such that the vertical lines of the grid plate are parallel to the orientation of the magnetic needle (namely, the direction of the geomagnetic field lines); the conducting wire is parallel to the horizontal lines of the grid plate, namely, the conducting wire is perpendicular to the geomagnetic field lines. The distance between the conducting wire and the grid plate is 4 cm. The magnetic needle is placed underneath the conducting wire, as shown in Figure 5.

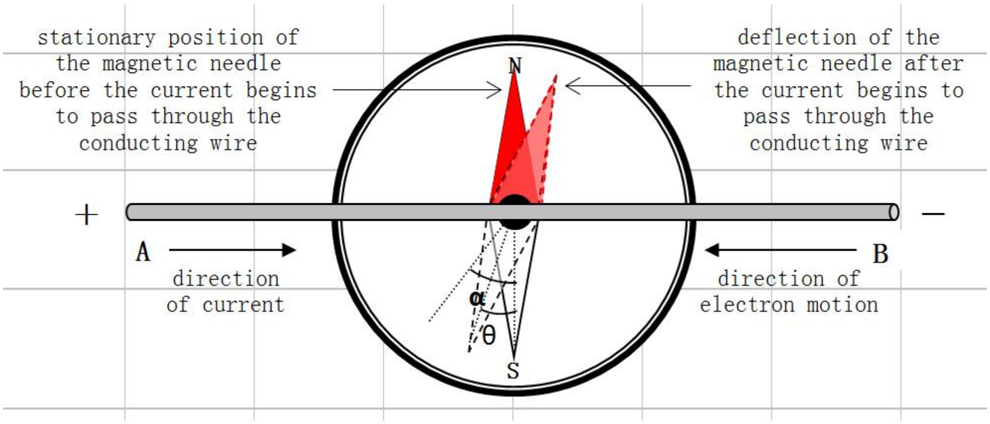

Figure 5 Schematic illustration of the magnetic effect of a current carried by a conducting wire perpendicular to the geomagnetic field

When the current through the conducting wire is traveling in the direction from west to east, the magnetic needle is deflected clockwise. The deflection angles θ of the magnetic fields corresponding to changing currents through conducting wires with different cross sections are presented in the table 1.

table 1

Deflection angle of magnetic needle / Current / Cross section of conducting wire	2A	3A	4A	5A
4 mm^2	0.8°	1.2°	1.7°	2°
2.5 mm^2	0.5°	0.8°	1.0°	1.2°
1.5 mm^2	0.3°	0.6°	0.8°	1.0°

If the magnetic field lines of the current-driven magnetic field are perpendicular to the current-carrying conducting wire, namely, the current-driven magnetic field at the position of the magnetic needle is parallel to the geomagnetic field, then the magnetic needle is not deflected. Therefore, the fact that the magnetic needle is deflected indicates that the magnetic field produced by the current and the geomagnetic field are not parallel.

Obviously, the deflection angle of the magnetic needle, θ, is the position at which the counterclockwise magnetic moment L_E of the geomagnetic field on the magnetic needle is equal to the clockwise magnetic moment L_I of the current-driven magnetic field on the magnetic needle, namely, $L_E=L_I$. Therefore, the deflection angle α of the field lines of the current-driven magnetic field should be greater than the deflection angle θ of the magnetic needle, namely, $\alpha>\theta$.

The magnetic field of the electric current originates from the movement of free electrons on the surface of the conducting wire. Therefore, the fact that there is a deflection angle α in the magnetic field of the current indicates that the free electrons do not move in a straight line along the conducting wire. This phenomenon is not compatible with the current model. In the following, we provide the Theory of System Relativity's explanation for this phenomenon.

6.2. Model of current

6.2.1. Formation mechanism of current

We know that the free electron density ρ_e at the negative terminal of a power source is higher than that at the positive terminal. The higher the voltage V is, the larger the difference in the free electron density $\Delta\rho_e$ between the positive and negative terminals. If the conversion coefficient for the voltage and the difference in free electron density is k_V (its value is related to the material of the electrode), then the free-electron-density difference $\Delta\rho_e$ can be expressed in terms of the voltage V as follows:

$$\Delta\rho_e=k_V V \quad (3)$$

When external influences and the structural shape of the metal object are neglected, free electrons on a metal surface move irregularly in the critical field of the object. When we connect one piece of conducting wire to the two terminals of a power source, because the density of free electrons on the positive terminal is lower than that on the conducting wire, the free electrons on the surface of the conducting wire (including unbound electrons in the conducting wire) will diffuse to the positive terminal; meanwhile, because the density of free electrons on the negative terminal is higher than that on the conducting wire, the free electrons on the negative terminal will diffuse to the conducting wire. As shown in Figure 7, for such a conducting wire with a circular cross section, the irregular movement of the free electrons becomes regular directional movement, forming the current. The free electrons are called **electrons of current.**

Therefore, an ammeter actually measures the current formed by the free electrons on the surface of a conducting wire. Then, through its proportional relationship with the current formed by the unbound electrons in the conducting wire, the measured current can be converted into the current flowing through the entire conducting wire.

6.2.2. Magnetic effect of current

As mentioned above, the directional movement of free electrons causes the polarity of the electrons to be oriented in the same direction. As a result, adjacent free electrons couple with each other to form a chain structure, namely, an electron chain, as shown in Figure 6. Thus, the irregular angular motion and linear motion of the free electrons is converted into the spiral motion of these electron chains along the surface of the conducting wire, as shown in Figure 7.

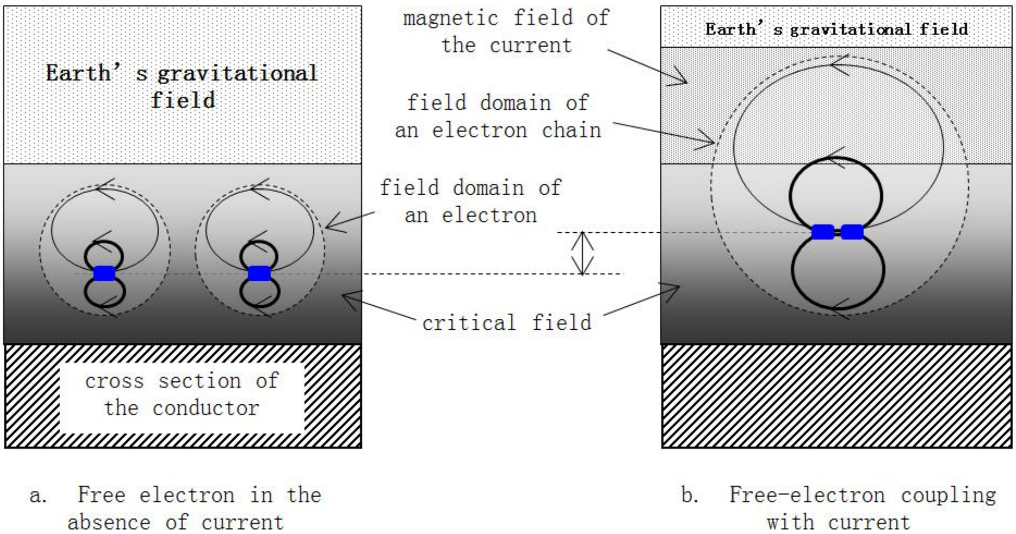

Figure 6 Schematic illustrations of electron chains and the magnetic field of a current

In the electron chains, the field lines of adjacent electrons are mutually coupled. The coupled field lines bind the electrons together. This combined force is called the coupling force; in electromagnetic theory, it is known as magnetic force.

After the electrons become coupled, the field lines of the **coupled body** (namely, a composite particle with weak stability) overflow the critical field and disperse throughout the space surrounding the conducting wire. The field formed by the coupled field lines of the electrons around the conducting wire is called the **magnetic field of the current**; in electromagnetics, it is called a magnetic field. The angle α between the field lines of the current-driven magnetic field and the direction perpendicular to the conducting wire is depicted in Figure 7b. Because of this angle, in the experiment described above (section 6.1), the magnetic needle is deflected clockwise; in the experiment, if we reverse the current, the magnetic needle will also be deflected clockwise. If the current is sufficiently large, the deflection angle of the magnetic needle will reach (180°-α), which is equivalent to rotating Figure 7b by 180°. Hence, we can derive the explanation for the deflection of the magnetic needle, namely, the repulsive force of the magnetic field of the current on the magnetic needle will cause the clockwise deflection of the magnetic needle.

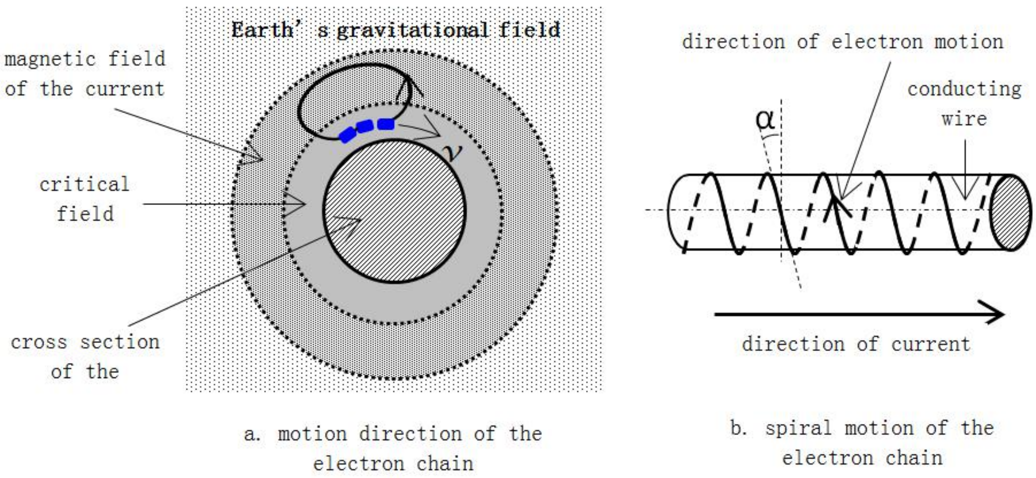

Figure 7 Schematic illustration of the current model

Hence, instead of being a field without sources, a magnetic field is a field with sources for which directionally moving free electrons serve as the vortex source. The field lines of the magnetic field move with these free electrons. Because of the uniform distribution of the free electrons on the surface of a conducting wire, the macroscopic magnetic field appears to be stationary. Therefore, the magnetic field and the electric field are unified.

6.2.3. Interaction of conducting wires with current

According to the principle described above, it is not difficult to understand the phenomenon in which two parallel conducting wires carrying currents traveling in the same direction attract each other, whereas two such wires carrying currents traveling in opposite directions repel each other. As shown in Figure 8, the rotational directions of the magnetic field lines generated by currents traveling in the same direction are the same. Between the two conducting wires, the directions of the current-driven magnetic field lines are opposite and mutually coupled, and these coupled field lines (field rings) generate a coupling force F that causes a mutual attraction between the two conducting wires, which is known in physics as the **Ampere force**. From the above discussion, we can derive the **principle that currents traveling in the same direction will attract each other**. The rotational directions of the magnetic field lines generated by currents traveling in opposite directions are opposite. Between the two conducting wires carrying these currents, the directions of the current-driven magnetic field lines are the same and therefore repel each other, thereby establishing the **principle that currents traveling in opposite directions will repel each other.**

The nature of the interaction between current-driven magnetic fields is an interaction between free electrons with directional movement, which is the essence of the Ampere force. Therefore, the magnetic force, the Coulomb force, and the Ampere force are unified.

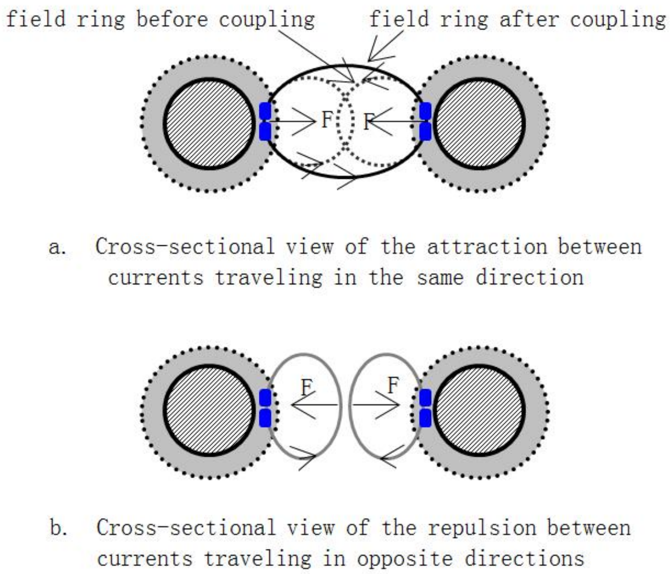

Figure 8 Principle of interaction between currents

The unbound electrons in a bulk current do not contribute to the magnetic field of the current. The primary role of these unbound electrons is to cause the excited radiation of nuclei by disturbing the nuclei (corresponding to the resistance acting on the electrons) and to further cause the generation of heat or light (such as the heating of a motor or the lighting of an incandescent lamp) in conductors. By contrast, free electrons move spirally on the surface of a conductor without being subject to any damping, which is precisely the phenomenon of room-temperature superconductivity that we have hoped to observe.

7. Closings

In short, the electron is a structured particle, mass is the description of its neutral field, and charge is the description of the polar field; Electric field is a kind of polar field, it does not have positive and negative power, but there is the difference between the intrinsic field and the covariant field; The spiral motion of free electrons on the surface of the wire is the phenomenon of room-temperature superconductivity.

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