A charge-quantization model based on virtual spacetime

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Abstract

Nearly 100 years have passed since the Dirac charge quantization model was established, but unfortunately one of the most important factors, magnetic monopoles, has not yet been detected. This paper attempts to solve this problem using the theory of virtual spacetime or imaginary spacetime. By treating the electric field rotation of electrons and protons as an infinitely long solenoid, and then calculating the magnitude of the magnetic charge carried by the magnetic monopole from the known parameters of the electrons and protons. In this way, it can be seen whether such a result can meet the requirements of charge quantization. The calculation results show that if the magnetic monopole is confirmed in the presence of virtual spacetime, the conditions for quantization of the charge can be automatically satisfied. This proves that the singular strings connecting electrons and protons cannot be observed. The automatic satisfaction of the charge quantization condition means that there can be no singular strings in the physical world that do not meet the charge quantization conditions.

1 Introduction

In the 20s of the last century, Dirac explored the quantization of electric charges. By introducing a singular string, as long as certain quantization conditions are met, the wave function of the electric field or magnetic field will not produce a physical effect on the singular string. The Dirac charge quantization model is physically and mathematically perfect. Nearly 100 years later, there is no better physical or mathematical model to explain the quantization of electric charge. However, magnetic monopoles must be introduced in the conditions of charge quantization. However, nearly 100 years have passed so far, and there is no conclusive evidence of the existence of magnetic monopoles. This also led to Dirac in his later years who seemed to have the idea of abandoning the magnetic monopole hypothesis.

However, at present, through the assumption of virtual spacetime or imaginary spacetime [1], we can very effectively place the existence of magnetic monopoles in virtual spacetime. Considering that the electric and magnetic fields in the electromagnetic field are very symmetrical, in the face of the physical laws of the unobservable virtual spacetime, we can transfer the laws in the real spacetime to the virtual spacetime according to the requirements of symmetry.

In this paper, some important properties of magnetic monopoles will be analyzed through existing observation experimental data of electrons and protons. See if the current charge characteristics of electrons or protons can be used to obtain results that meet the requirements of Dirac quantization of charge.

2 Flaws in the Dirac charge quantization model

The model of Dirac's charge quantization is relatively perfect, but there are some problems, and these flaws are mainly manifested

First, there is no definitive experimental evidence for the existence of magnetic monopoles, and the existence of magnetic monopoles is a necessary condition for the Dirac quantization of charge.

Second, the Dirac quantization of the charge only describes the magnetic monopoles produced by the rotation of the electric field. If the electric and magnetic fields under consideration are symmetrical, since the rotation of the electric field can produce magnetic monopoles, the rotation of the magnetic field should also be able to generate an electric charge. To solve this problem, Schwinger's two-string singular potential can be used. The two-string singular potential solves the problem of both magnetic monopoles and electric charges exist at the same time.

Third, the Dirac charge quantization condition only tells us why the existence of singular strings cannot be observed, but if there are still singular strings in the universe that do not meet the requirements for charge quantization, can these singular strings that cannot be quantized by charge be measured? And if you can't answer this question, it means that you can't explain how Dirac's strange strings are produced.

3 Elementary particle model based on Virtual Spacetime

The elementary particle model based on Virtual Spacetime [2] assumes that electrons and protons are symmetric particles. Due to the existence of virtual spacetime or imaginary spacetime, this means that electrons and protons are complex of electric charges in real spacetime and magnetic monopoles in virtual spacetime. The energy contained in the magnetic monopole of Virtual Spacetime is reflected in the mass of the particle in Real Spacetime.

Because the electric field energy of electrons in real spacetime is larger, considering the need for symmetry, the magnetic monopole energy of electrons in virtual spacetime will be relatively small, which results in a smaller mass of electrons. The electric field energy of protons in real spacetime is smaller, and their magnetic monopole energy in virtual spacetime will be large, which leads to a relatively large mass of protons.

From the supersymmetric Maxwell's equations [1], it can be seen that the electric and magnetic fields have very good symmetry. This symmetry is caused by the coexistence and disappearance of electric and magnetic fields. This means that the movement of the electric field will also lead to the movement of the magnetic field. The existence of a magnetic field must also mean the existence of a corresponding electric field. The two are inseparable.

4 The essence of a singular string is a fluid vortex

Since there is spin in the electric fields of both electrons and protons, we can further assume that this singular string is actually spinning as well. This forms a "vortex tube" similar to a vortex in a fluid. Then we can use some methods of fluid mechanics to deal with electrons and protons, and their corresponding magnetic monopoles.

4.1 Structure of electromagnetic field vortex tubes

Consider that in the universe, the number of positive and negative charges is exactly equal. This also means that the number of electrons and protons is exactly equal. Therefore, we can think of electrons and protons as two properties of a physical agent. More specifically, electrons and protons can be connected to each other with a single string. Since this string cannot be observed, Dirac called it a "singular string".[3] In this way, whether in real spacetime or virtual spacetime, we cannot observe the existence of singular strings. Only individual electrons and protons are actually observed.

If we consider that this singular string is the vortex in the fluid, then the spin of the electric field or magnetic field is the vortex motion of the fluid. It's just that unlike the fluids we are familiar with, the structure of this electric or magnetic field vortex is simpler. The fluid equation that describes the motion of an electric or magnetic field in such a vortex tube is Maxwell's equations.

4.2 Quantization of magnetic monopoles of Schwinger's singular strings

If the singular string between electrons-protons or magnetic monopoles is regarded as vortex tubes in fluid mechanics, then these vortex tubes are similar to coils, and if they are rotations of electric fields, magnetic fields can be generated at both ends, forming magnetic charges or magnetic monopoles. If the magnetic field rotates in it, an electrostatic field can be generated at both ends, forming an electric charge. Then, through the quantization conditions of Schwinger's two-string singular potential, the relationship between the rotation of the electric field and the magnetic charge of the magnetic monopole can be calculated.

For electrons, whose electromagnetic radius is a, the magnetic induction intensity generated by spin is calculated as $B = \mu i/2a$

where i is the current intensity and μ is the magnetic permeability in a vacuum.

Then

$$B = \frac{\mu i}{2a} = \frac{\mu}{2a}\frac{e\omega}{2\pi} = \frac{\mu}{2a}\frac{e\omega}{2\pi} = \frac{\mu}{2a}\frac{em_p a^2\omega}{2\pi a^2 m_p}$$

If we consider the spin angular momentum of electrons

$$m_p a^2 \omega = \frac{\hbar}{2}$$

In elementary particle model based on Virtual spacetime, an electron is a complex of the magnetic monopole of Virtual spacetime and the electrostatic field of electrons in Real spacetime. Therefore, suppose that the spin of an electron is generated by the rotation of the magnetic monopoles in Virtual SpaceTime. Considering the symmetry [2], it can be known that the mass brought by the magnetic monopole of the electron is equal to the mass of the proton. Correspondingly, the mass brought by the magnetic monopole contained in the proton is equal to the mass of the electron.

such

$$B = \frac{\mu}{2a}\frac{e\hbar}{4\pi a^2 m_p}$$

If the vortex tube of the electric field will form a magnetic monopole at both ends, the magnetic field strength of the magnetic monopole is

$$B = \frac{\mu}{4\pi}\frac{g_p}{a^2}$$

So

$$g_p = \frac{e\hbar}{2am_p}$$

The Dirac charge quantization condition is

$$eg_e = \frac{nh}{\mu}$$

However, if both charge and magnetic monopole are considered, Schwinger charge quantization condition need to be used, i.e

$$eg_e = \frac{2nh}{\mu}$$

So

$$eg_e = \frac{e^2\hbar}{2am_p} = \frac{2nh}{\mu}$$

Considering

$$am_p = bm_e$$

where *b* is the electromagnetic radius of the proton.

And according to the literature [2].

$$b = \frac{e^2}{8\pi\varepsilon m_e c^2}$$

Therefore

$$n = \frac{e^2\mu}{8\pi am_p} = \frac{e^2\mu}{8\pi bm_e} = 1$$

It can be seen that the conditions for quantization of the charge are automatically satisfied. This automatic satisfaction also means that there can be no charge without quantization. That is, if an electric field or magnetic field is formed in a vortex, the charge or magnetic charge at both ends of the vortex must be quantized.

In this way, the vortex connected between electrons and protons is not visible. The same calculation can be done for magnetic monopoles in Virtual spacetime. Eventually, we can find that the singular strings of magnetic monopoles connected to each other in Virtual spacetime are also unobservable.

5 Conclusions

From the perspective of this charge quantization condition established in this paper, because the magnetic monopole is located in virtual spacetime or imaginary spacetime in the model, the existence of magnetic monopoles will not be observed in real spacetime, which can effectively solve the fact that the existence of magnetic monopoles cannot be detected at present.

But the fact that magnetic monopoles cannot be observed does not mean that magnetic monopoles do not produce observable effects in real spacetime. Since the energy in Virtual spacetime also affects the gravitational interaction of Real spacetime, this also means that the energy of magnetic monopoles is mainly expressed as the rest mass of particles. And the mass of this particle will also directly affect the spin angular momentum of the particle.

The electric field spin of an electric charge can also be understood by borrowing the concept of vortex tubes in fluid mechanics. The structure of this vortex can be calculated using the static magnetic field or electrostatic field generated by the solenoid in electromagnetism. This ensures that the model is computable.

From the results of the calculation, it can perfectly meet the charge quantization condition proposed by Dirac, that is, under the condition of quantization of charge or magnetic charge, the singular string of the connection between positive and negative charges cannot be observed. This also proves the correctness of the model.

This model also gives us another insight, which is that since the formation of vortex tubes is an important feature of fluid dynamics, it also means that we may have to reconstruct the vacuum model. The vacuum may be filled with a fluid that cannot be observed, but when energy is entered, it can cause the fluid to be disturbed, resulting in turbulence, and thus various vortex structures. The vortex produced by these turbulences is the matter world in our observable universe. Because these vortex tubes ensure the formation of electrons, protons and corresponding magnetic monopoles.

References

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