The lost energy: Electrostatic energy of electrons

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Abstract: There were enough evidences to prove that the radius of electrons is very small. In fact, this radius reflects the very small charge radius of electrons. After all, if the charge radius of an electron is large enough, our existing technology can certainly measure it. The problem now is that if the charge radius of the electron is very small, then the energy of the electrostatic energy possessed by the electron will be very large, at least much larger than the mass of the electron itself. However, in various calculation processes, we had ignored this electrostatic energy of electrons. For example, when calculating the energy level of hydrogen atoms, we only needed to consider the quality of electrons, not the energy possessed by the electrostatic field of electrons. So where did the static electricity of this part go? This article believed that this part of the electrostatic energy distribution corresponded to the so-called "space-time" concept, and it was probably an important part of what we called "dark energy". This article made some estimates of the distribution of electrostatic energy, and estimated the distribution of electrostatic energy for the electron, the earth, and the Milky Way based on the assumed distribution of electrostatic energy in the solar system.

Keywords: Electron; Electrostatic field; Dark matter

1 Introduction

The question of electron's structure is a basic question of modern physics. Early theories regarded electron as a spherical structure, while quantum field theory regarded electron as a point particle without structure. Experiments have also confirmed that if the electron has a radius, the radius will be less than 10^{-17}m, and some experimental results show that the radius of the electron is less than 10^{-22}m [1]. Of course, due to the smaller scale of the micro-world, our current physics knowledge seems far from enough, but at least we can be sure that the charge radius of the electron is indeed very small, which also causes such a small charge radius will produce a very large electrostatic field energy.

Gauge field theory solves the problem of infinite self-energy of electrons through renormalization. But it does not solve the problem of why the energy possessed by the electrostatic field of electrons is ignored in many calculation processes.

Considering the strict inverse square law of the electrostatic field of electrons, if the experimental result is correct, then the electrostatic field that conforms to the inverse square law must be existed in less than 10^{-17}m, otherwise it will be accurately measured by experimental instruments.

The problem now is that we already have enough experimental evidence to prove that the electrostatic field is energetic. If the calculation is performed according to the upper limit of the experimental data of 10^{-17}m, the minimum energy of the electrostatic field that produced by the charge that evenly distributed on the spherical shell with a radius of 10^{-17}m, then the energy it has will reach about 10MeV, which is far more than the mass of electron itself. If this mass affects the movement of electrons, for example, as a component of the inertial mass of electrons, it will cause a major change in the structure of the entire hydrogen atom. But the actual situation is that in the calculation process, we can ignore the energy of this part of the electrostatic field.

According to my previous calculation results [2], if the radius of the electron charge is considered to be about 10^{-19}m, it can be calculated that the electrostatic energy it has is about 1GeV.

Now let us consider another hypothetical situation, namely the symmetry of electrons and protons. If the electrostatic field energy of an electron is equal to the mass of a proton, and the mass of an electron is equal to the electrostatic field energy of a proton. In this way, the most basic particles of matter in our entire universe, electrons and protons have a very beautiful symmetry. In this case, the energy of the electrostatic field of the electron will be 938MeV, and the electrostatic field energy of the proton will be 0.51MeV.

The electrostatic field energy of the proton is relatively small. If the proton is regarded as a spherical shell with uniform charge distribution, the radius of the spherical shell is about 10^{-15}m, which is basically consistent with the current experimental results [3, 4]. The proton's electrostatic energy calculated according to this radius is about 1MeV. This is basically consistent with our expectations.

2 A contradictory question

If electrons have such a large electrostatic energy, why do we never seem to have considered the physical effects of such a large electrostatic energy in various physical calculation processes? After all, even if the calculation is based on the hydrogen atom radius, which is a macroscopic scale that can be processed by classical physics, the energy generated by such a large-scale electric field distribution is enough to have a very large impact on the movement of electrons, but in the calculation process of various quantum mechanics, it is true that the electrostatic field energy of electrons has never been considered as a component of electron mass.

Then we further consider that if the electrostatic energy of the electron reaches the order of the mass of the proton, this means that the total energy or total mass corresponding to each atom we measure now will double. Or more intuitively, our current earth mass will also double. Of course, the mass of the sun will also double.

If this is the case, it means that the current orbit of the earth around the sun will produce very big changes. From the formula we now calculate the acceleration of gravity, the acceleration of gravity that each of us bears will also increase by 4 times. None of this has happened. This also shows that the electrostatic field energy of electrons should not have an observable effect on the inertial mass and gravitational mass of matter.

Paradoxically, our existing knowledge of physics really tells us that the electrostatic field has energy, otherwise the capacitor cannot store electrical energy!

Therefore, if the electrostatic field inside the capacitor has energy, then the electrostatic field formed by the electronic charge must also have energy, and this energy cannot be equal to the mass of the electron. There have been many experimental evidences to prove this view.

Then, according to the mass-energy relationship of relativity, energy must be transformed into mass, namely the famous Einstein mass-energy relationship

$$E = mc^2$$

It can be seen that under certain conditions, the energy possessed by the electronic electrostatic field will certainly be able to produce a "mass effect."

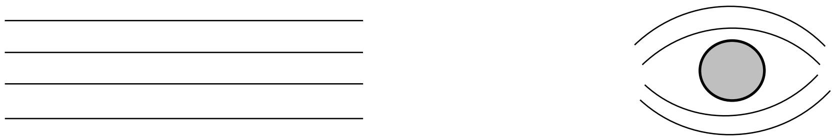
But the problem now is that we have not observed such a "mass effect" of the electrostatic field of electrons.

3 A hypothesis: The electrostatic field is the form of space-time

We can assume that the electrostatic field energy is a form of space-time, and the electrostatic field energy can be accumulated, so the space-time can also be accumulated together to form a larger space-time. In this way, the actual distribution range of the electrostatic field is not limited to a small area around the charged particles, but countless electrostatic fields are accumulated together, covering an area far beyond the range of motion of the particles, so that there is no need to consider the energy of the electrostatic field on the particles.

In this way, the space-time around us is actually formed by the electrostatic field energy. When a mass system composed of countless electrons, protons and other particles exists, due to the existence of a large number of electrons and protons possessing the electrostatic field energy, these electrostatic fields will construct a spacetime range around the mass using the cumulative effect. At last, the big space-time come out.

The energy of these electrostatic fields has the effect of elastic substances. Therefore, when a substance has a mass, the mass will form a squeezing effect on the spacetime formed by the energy of the electrostatic field [2], which in turn causes the spacetime to bend and generate gravity. As it is shown in Figure 1.



Straight electrostatic field energy

Bending electrostatic field energy caused by mass extrusion

Figure 1. The space-time formed by electrostatic field energy

4 Energy distribution of electrostatic field

According to the general theory of relativity, mass causes space-time bending. The reason why space-time bends is that we can assume that mass or energy squeezes space-time. Because the mass needs to occupy a certain space-time range, the original flat space-time is squeezed and bent. For mass M, we can use the Schwarzschild radius as a mass occupying the space-time range [2], then the radius is

$$R_m = \frac{2GM}{c^2}$$

For the occupation of space-time by the energy of the electrostatic field, consider that most of the matter in the universe is composed of charged particles such as electrons and protons. We can assume that there is a basic mass unit m, the radius of the space-time range occupied by the electrostatic field contained in it is r_c.

Then the energy volume of the electrostatic field of each basic mass unit is

$$V_c = \frac{4}{3}\pi r_c^3$$

A system of N basic mass units, the electrostatic field volume is

$$V = NV_c$$

The total mass of N basic mass units is

$$M = Nm$$

The corresponding radius is

$$R_c = \sqrt[3]{\frac{3}{4\pi} N V_c} = \sqrt[3]{\frac{M}{m}} r_c = \sqrt[3]{kM} r_c$$

Where

$$k = \frac{1}{m}$$

Taking the solar system as an example here, it is currently known that 99% of the mass of the solar system is concentrated in the sun, and if the solar system is based on the current observation data, it is more appropriate to use 10 light years to estimate the extension of the solar system in space-time. It can be assumed that this is the space-time range occupied by the electrostatic field energy in the solar system. In this way, we can determine the radius of the space-time range occupied by the electrostatic field energy in the solar system as

$$R_{sun} = \sqrt[3]{kM_{sun}} r_c \approx 10^{17} m$$

Then we can use this data to estimate the energy distribution range of the earth's electrostatic field

$$R_{earth} = \sqrt[3]{kM_{earth}} r_c = \sqrt[3]{\frac{M_{earth}}{M_{sun}}} \sqrt[3]{kM_{sun}} r_c \approx \sqrt[3]{\frac{6 \times 10^{24}}{2 \times 10^{30}}} \times 10^{17} m$$

In this way, the energy distribution range of the earth's electrostatic field can be calculated as

$$R_{earth} \approx 10^{15} m$$

It can be seen that this is also a very large number. Its range is approximately a radius of 0.1 light years. Such a large coverage area can basically determine that the energy distribution of the electrostatic field near the earth is uniform, and will not have an observable impact on the movement of the earth and the moon.

For the Milky Way, its mass is about 1 trillion solar masses. Then it can be calculated that such a large mass causes the energy distribution range of the Milky Way's electrostatic field energy to be

$$R_{MW} = \sqrt[3]{\frac{M_{MW}}{M_{sun}}} \sqrt[3]{kM_{sun}} r_c \approx \sqrt[3]{1 \times 10^{12}} \times 10^{17} m$$

$$R_{MW} \approx 10^{21} m$$

That is about 100,000 light years. This value is about the size of the Milky Way.

However, considering that the material distribution in the Milky Way is relatively uniform, that is to say, unlike the majority of the mass in the solar system concentrated on the sun, the mass distribution around the Milky Way will cause the electrostatic field distribution range to be larger than the calculated value. In this way, the distribution of the electrostatic field of the galaxy masses may exceed one hundred thousand light years. However, the actual value should be similar to the estimate.

If we use this data to estimate the space-time range occupied by the electrostatic field energy generated by an electron, the calculation result is below.

Using the electron's mass as the unit mass m, and then substituting the solar mass M, this can be calculated

$$R_{sun} = \sqrt[3]{\frac{M}{m}} r_c \approx \sqrt[3]{\frac{2 \times 10^{30}}{9 \times 10^{-31}}} r_c \approx 2 \times 10^{20} r_c \approx 10^{17} m$$

In this way, the radius of the electrostatic field energy range of the electron can be calculated as

$$r_c \approx 5 \times 10^{-4} m$$

In other words, the energy distribution of the electrostatic field of the electron is about 0.5mm. It seems that this number is very large compared to a microscopic particle, but I don't know what special meaning this number has. Of course, the accuracy of the entire calculation process is not enough, and there may be a relatively large error range.

However, this can be qualitatively verified from the fact that macroscopic experimental devices such as Millikan's oil-drop experiment can measure the charge of a few electrons. Because the diameter of oil drop in some Millikan experimental devices can reach 0.5~1mm, and each oil drop can carry about ten electrons, indicating that an electric field of this size and diameter can already be detected by the experimental device, which means that the static electricity of electron's electrostatic field energy range should be at least millimeter. Therefore, the energy distribution range of the electrostatic field estimated by this paper still has certain qualitative significance.

5 Electrostatic field energy and dark energy

From the above analysis results, we can see that the energy possessed by the electrostatic field is huge, and the energy of the electrostatic field possessed by electrons and protons is roughly equivalent to the atomic mass they constitute. However, the energy distribution range possessed by electrostatic sites far exceeds the range covered by mass. This article assumes that this electrostatic field energy can be regarded as a form of space-time existence.

It is very interesting that we have not taken into account the energy possessed by the electrostatic field in the dynamic calculation process in all aspects. If the energy of the electrostatic field is taken into account, it means that the mass of the earth will be doubled, which will definitely have a great impact on the earth's orbit.

From the analysis process in this article, we can see why we can ignore the energy of the electrostatic field in the general calculation process. This is because the total coverage of the electrostatic field energy like the electrons and protons that make up the earth has reached the range of 0.1 light years. Such a large coverage area far exceeds the diameter of the earth, and even extends to the edge of the solar system. Therefore, the actual situation is that the energy distribution of the electrostatic field around the earth, or space-time, can be regarded as uniform. The earth's orbit in such a uniform space-time will not be significantly affected.

The same is true for the solar system and the entire Milky Way. The above calculation results show that the total energy distribution of the electrostatic field of the Milky Way can reach 100,000 light years, which is similar to the diameter of the entire Milky Way.

Although the energy distribution range of these electrostatic fields is too large for the earth, it will not affect the calculation of the earth's orbit. But if you look at the range of galaxies, this electrostatic field energy may have an observable effect on the movement of stars. There are already many facts supporting the existence of dark energy in the observation of cosmic astronomy. These dark energies also have a gravitational effect. It is generally believed that these dark energies are an important factor in maintaining the integrity of galaxies. Therefore, if we regard this electrostatic field energy as a kind of dark energy, it should also be a relatively reasonable inference. After all, the distribution of electrostatic field energy seems to be relatively consistent with some theoretical dark energy distribution ranges.

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