

Model Explaining the Electrostatic Force

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The equation describing the electrostatic force between two static charged particles is widely used in engineering calculations because it is simple to use and requires little mathematical knowledge. It is a simple equation that describes the electrical phenomena at low speed for electrically charged particles.

Several attempts have been undertaken to understand the real foundations of the force phenomenon governing the behaviour of static charged particles. We have the mathematical tools to predict the behaviour of two particles, but do we really know where does the attraction or repulsion of charged particles come from?

In this document, we want to show that the electrical forces simply do not exist. The concept of force is, however, useful and easy to use. For this reason, if we want to keep this concept, it is easy to bring up and use. However, we show that the true principle which underlies this is that all electrical particles are immersed in a huge bath of photons which creates a thermodynamic radiation pressure on the particles.

KEY WORDS: Electrical Force, Photon, Thermodynamic Radiation Pressure

1. INTRODUCTION

We will begin by outlining the hypothesis that the forces do not exist and that it is only a useful concept.

Second, we will try to make a model of the photon which creates a thermodynamic radiation pressure in the vacuum.

Then, we will analyze what happens between two electrically charged particles.

We will see that it is possible, if we wish, to show the concept of electrostatic force between charged particles, but the true principle remains the thermodynamic radiation pressure that forces the particles to be attracted or to repelled. The transmission of momentum through collisions between photons from space and particles in relation creates this radiation pressure.

2. DEVELOPEMENT

2.1. Forces do not Exist

Let's start by making the following shocking statement; gravitational forces, electromagnetic and nuclear do not exist. In fact, no force exists. The forces are concepts accompanied by useful mathematical tools to predict the interactions between different elements of matter. But these simply do not exist.

In this article, we will focus on explaining the attraction and repulsion of electrically charged particles. Using the concept of force, we will quantify these behaviours in the form of equations. As the concept of force is useful and easy to understand, we will show that it is possible to display this concept as a mathematical result but not as an explanation for the phenomena of attraction and repulsion of electrical charges.

2.2. The Photon is the most Elementary Particle

Let's suppose that, in its simplest representation, all matter is made of confined photons. For proof, Einstein stated the following equation [1]:

$$E = m_0 \cdot c^2 \quad (1)$$

According to the CODATA 2010 [2], the speed of light in vacuum is $c \approx 299792458$ m/s.

Let us consider the meaning of this equation. It says that it is possible to convert a mass m_0 at rest into a certain energy (photons) by the disintegration of matter. But this equation is not unilateral. It is also possible to take the same amount of energy and convert it in mass. This equation works bilaterally. If, in final, the photons are the result of the disintegration of matter, we conclude that somewhere, all particles are in reality made of confined photons. The electrons, protons and neutrons are not the most elementary particles. Not even quarks. Photons appear to be the most basic existing particles.

2.3. Model Representing the Thermodynamic Vacuum

The vacuum, as we are used to see it, is a lack of molecules and atoms. However, the vacuum is not nothingness as its name might suggest it. The vacuum is filled

with photons. It is a real bath of electromagnetic waves with different wavelength from $2\pi \cdot L_p$ (where L_p is the Planck length) up to the apparent circumference of the universe $2\pi \cdot R_u$ (wherein R_u is the apparent radius of the luminous universe). To avoid any misunderstandings with the term "vacuum" which might seem to refer to a complete absence of all, the history might have kept the original name "ether" for the vacuum. However, although we do not like that term and that we try to avoid it in order to keep the most recent and most used words, we will retain the term "vacuum". However, we warn the reader that for us, the thermodynamic vacuum is full of photons which strikes the masses from all sides. The "vacuum" is simply a void of matter.

3. ELECTROSTATIC FORCE BETWEEN 2 STATIC CHARGED PARTICLES

In a second step, let's try to find a model that explains the electrostatic force between two static charged particles using the principle that the masses are subjected to a thermodynamic radiation pressure of photons that collide the related particles.

To successfully explain the electrostatic forces, we have to make a conceptual idea of the photon for our understanding.

3.1. The Universe is Full of Photons

The vacuum of the universe is only an absence of matter. However, it is full of photons of all wavelengths situated between $2\pi L_p$ and $2\pi R_u$.

Here, L_p is the Planck length and R_u is the apparent radius of curvature of the luminous universe. According to the CODATA 2010 [2], $L_p \approx 1.616199(97) \times 10^{-35}$ m. However, according to our previous works [3], $L_p \approx 1.616125436(53) \times 10^{-35}$ m. According to our best estimates, the apparent radius of the luminous universe [4] would $R_u \approx 1.2831078806(68) \times 10^{26}$ m.

These photons may come up and go from the vacuum. These photons collide with atoms and elementary particles on all sides. These photons can be represented by small tornadoes in the time-space having the shape of springs. From a front point of view (in the travelling direction), the photons are like a circular disc in rotation with a radius equal to the Planck length L_p . From a side point of view, they look like a sine wave.

What gives different wavelengths for these photons is the fact that these tornadoes rotate faster or slower. Indeed, it's like having a tourniquet. The radius of a tourniquet will never exceed that required to ensure that the tangential speed of the periphery is the speed of light. So even if the photon has a really a radius equal to the Planck length L_p , the photon wavelength is given by the distance that light can travel during the time t required for the photon to perform a complete rotation on itself.

$$\lambda = 2\pi \cdot \frac{c}{t} \quad (2)$$

Photons are born by identical pairs having an opposite moving speed. The sum of the torques is zero. The sum of the amounts of movement is zero. Note that there is as much chance that the photons are born with a rotation clockwise or counter-clockwise.

Like all the other particles, when a photon is created, an anti-photon is created. One rotates in a direction and the other rotates in the opposite direction. The other features are similar and indistinguishable. The universe is a big bath of photons of different wavelength that move in all directions

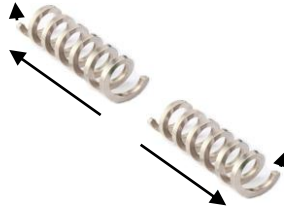


Figure 1) Creation of a pair of photons in vacuum.

3.2. The Repulsive Force Between Two Particles of the Same Charge

To help understanding the next step of our development, we must imagine a turntable rotating at a certain angular velocity ω . Let's suppose now that we drop a ball on the turntable. As the ball does not have the same speed as the turntable, it will bounce then will be deflected on any side. The only way for the ball to bounce back and return to its starting point is to fall with an identical torque and an identical way than the turntable.

Let's imagine two charges of the same sign (for example, an electron and a proton) spaced with a distance r . Each particle is subjected to repeated impacts of

photons in the space. These photons collide with the particle on all sides. However, photons located in the axis between the two particles will start by hitting a particle and then will bounce off on the other. As the two particles have the same charge, they are identical as two turntables. Photons with the same rotational speed as these particles will rebound on each particles. They will exert a repulsive pressure between the two particles. This pressure will be greater as the particles are close to each other.

Of course, there are continually formation and destruction of photons in space. Therefore, the smaller the particles are moved away from each other, the more likely new photons are formed in the axis between the two particles. The photons bouncing along the axis between the two particles will themselves more likely to be diverted from their path by photons traveling in other directions. Also, the time interval required for a percussion increases with distance. In result, we find that the further apart the particles will be, the lower will be the "repulsive force".

3.3. The Attraction Force between Two Opposite Charged Particles

Let's imagine two opposite charges (for example, two electrons or two protons) spaced with a distance r . Using the same principle as above, we find that each particle will be hit by the photons in the same manner as above. The difference is that in the axis electron-proton, the photon that will be in phase with the electron will necessarily be out of phase with the proton, and vice versa. Therefore, when a photon will bounce on a particle in the axis electron-proton, it will end up being ejected from this axis as soon as it will touch the other particle. After a very short time, a photon quantum vacuum is being made in this axis. No more photon can stay there. The particles are then pressed against each other by the radiation pressure from outside.

Of course, as in the case of identical charges, there is continually formation and destruction of photons in space. Therefore, the further apart are the particles from each other, the more likely that new photons will be formed in the electron-proton axis and there will be more new photons that will make new collisions and less the particles will seek to be pressed against each other. In result, we will find that the further apart the particles are, the lower will be the "force of attraction".

3.4. The Zero Force between Two Neutral Particles

Now, let's imagine the following two options; two neutral charges or one non-neutral electric charge with a neutral charge, spaced a distance r . Using the same principle as above, we find that hitting the neutral particle in the axis between the two particles, there is as much chance that the same is expelled or photon bounces it. Therefore, the presence of a neutral particle removes any possible contribution to any acceleration due to the presence of the neutral particle. We will then say that there is no "force of attraction" and "repulsion" between the particles. This is what is predicted by the equation of the standard model describing the electric force between particles.

3.5. Evaluation of the Attraction/Repulsive Force between Two Charges

Let's try to evaluate the energy of repulsion contained between the two particles.

Let's consider the fact that the particles which enter into interaction are elementary and have a real physical size equal to a sphere of radius equal to the Planck length L_p . This is important because it is necessary that all the charged particles have the same physical size as photons, if not the size of the contact surface become an important characteristic. Like all elementary particles have the same physical size (for example, an electron is considered punctual and we make the hypothesis that it would have a real diameter equal to $2\pi L_p$ if it had no torque.

To facilitate the calculation, let's imagine now two electrons in the presence each other.

The photon that will be able to bounce between the two particles will rotate in phase with the two particles. Einstein has shown that the tangential velocity v of a rotating disc will cause to virtually increase the effective diameter of the disc to give it the following value:

$$\text{Circumference of the disc} = \frac{2\pi \cdot L_p}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (3)$$

In the case that we are concerned, we assume that the Lorentz factor is exactly equal to the value of the fine structure constant α .

$$\text{Circumference of the photon} = \frac{2\pi \cdot L_p}{\alpha} \quad (4)$$

According to the CODATA 2010 [2], the value of the fine structure constant is $\alpha \approx 7.297352565698(24) \times 10^{-3}$.

Of course, as the photon must travel a distance r between the two particles, the total effective length of the "spring" is given by the number n of turns that the spring will be to get from one point to another by advancing by increments equal to the Planck length:

$$\text{Spring length} = \frac{2\pi \cdot L_p}{\alpha} \cdot n \quad \text{où } n = \frac{r}{L_p} \quad (5)$$

So, the final length of the "spring" is equal to the wavelength λ of the photon bouncing between the particles:

$$\lambda = \frac{2\pi \cdot r}{\alpha} \quad (6)$$

The energy of this photon is given by:

$$E = \frac{h \cdot c}{\lambda} = \frac{h \cdot c \cdot \alpha}{2\pi \cdot r} \quad (7)$$

According to the CODATA 2010 [2], the value of the Planck constant is $h \approx 6.62606957(29) \times 10^{-34}$ Joule.s.

The energy E is the work required to space the two particles with a distance r with a constant force F_e :

$$E = F_e \cdot r \quad (8)$$

Looking for the repulsive force F_e between the two particles, we obtain, using equations (7) and (8), the following force F_e :

$$F_e = \frac{h \cdot c \cdot \alpha}{2\pi \cdot r^2} \quad (9)$$

Of course, if we multiply the numerator and denominator by the classical radius of the electron r_e multiplied by the square of the speed of light, that is to say $r_e \cdot c^2$, we will not have changed anything.

$$F_e = \frac{h \cdot c \cdot \alpha \cdot r_e \cdot c^2}{2\pi \cdot r_e \cdot c^2 \cdot r^2} \quad (10)$$

According to the CODATA 2010 [2], the value of the classical radius of the electron is $r_e \approx 2.8179403267(27) \times 10^{-15}$ m.

Let's remind that the duality wave-particle allows us to give the energy E_e of an electron with two ways; by the energy contained in the mass m_e of the electron and the energy of the wave:

$$E_e = m_e \cdot c^2 = \frac{h \cdot c \cdot \alpha}{2\pi \cdot r_e} \quad (11)$$

According to the CODATA 2010 [2], the value of the mass of the electron is $m_e \approx 9.10938291(40) \times 10^{-31}$ kg.

Starting from the equation (11) and by doing a few algebraic simplifications, we find the mass m_e of an electron for the following equation:

$$m_e = \frac{h \cdot \alpha}{2\pi \cdot r_e \cdot c} \quad (12)$$

Let's simplify the equation (10) with the help of the equation (12):

$$F_e = \frac{m_e \cdot r_e \cdot c^2}{r_e^2} \quad (13)$$

We can describe the square of the speed of light in the vacuum with the help of the vacuum permeability μ_0 and the vacuum permittivity ε_0 :

$$c^2 = \frac{1}{\mu_0 \cdot \varepsilon_0} \quad (14)$$

According to the CODATA 2010 [2], the value of the vacuum permeability is given by $\mu_0 \approx 4\pi \times 10^{-7}$ N/A² and the vacuum permittivity is given by $\varepsilon_0 \approx 8.854187817 \times 10^{-12}$ F/m.

Thanks to the equation (14), let's rewrite the equation (13) as follows:

$$F_e = \frac{m_e \cdot r_e}{\mu_0 \cdot \varepsilon_0 \cdot r_e^2} \quad (15)$$

Let's multiply the numerator and the denominator by a factor 4π without changing anything:

$$F_e = \frac{4\pi \cdot m_e \cdot r_e}{4\pi \cdot \mu_0 \cdot \varepsilon_0 \cdot r_e^2} \quad (16)$$

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We know that the charge of the electron q_{e-} (or q_e) and the antiproton q_{p-} is:

$$q_{e-} = q_{p-} = -\sqrt{\frac{4\pi \cdot m_e \cdot r_e}{\mu_0}} \quad (17)$$

According to the CODATA 2010 [2], the value of the charge of the electron is $q_e \approx -1.602176565(35) \times 10^{-19} \text{ C}$

The charge of the proton q_p and of the positron q_{e+} give:

$$q_{p+} = q_{e+} = \sqrt{\frac{4\pi \cdot m_e \cdot r_e}{\mu_0}} \quad (18)$$

By analyzing these last two equations more closely, and without going too much in detail, it appears that an electrical charge is in fact a rotating mass. Why it is assigned a characteristic of electric charge? What makes the difference between a positive and negative charge particle? It can not be a simple rotation. Imagine a disc that rotates clockwise. Looking at the same disk from the rear, it turns counter-clockwise. Therefore, it is impossible to characterize a charge by its simple rotation. So there must be a second characteristic; its direction of movement. By combining rotation and direction of movement, we get two charges in the opposite direction.

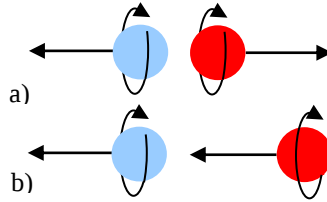


Figure 2) Visualisation of opposite charges.

- a)** The rotation way is the same but the moving way is opposite.
- b)** The moving way is the same, but the rotation way is opposite.

If we use the equation (17) in the equation (16), we obtain:

$$F_e = \frac{q_e^2}{4\pi \cdot \epsilon_0 \cdot r^2} \quad (19)$$

This equation is well known and represents the electrostatic repulsion force between two electrons having a charge q_e . Of course, we started from a special case where two particles having the same charge are put in presence of each other. If we generalize this equation for two any charges q_1 and q_2 , we get the following equation:

$$F_e = \frac{q_1 \cdot q_2}{4\pi \cdot \epsilon_0 \cdot r^2} \quad (20)$$

By convention, when the force F_e is positive, it is repulsive. When it is negative, it is attractive.

Attention, this equation is not relativistic. It only represents the case where we measure the force between two static charges. Let's remind that forces do not exist and that we use this concept only because it is practical and more natural for us. However, we know now that the result is a statistical average a multitude of impacts between photons and particles which create a thermodynamic radiation pressure.

4. CONCLUSION

As our model leads to the equation governing the electrostatic force between two electrically charged particles, we conclude that it can be used in an educational perspective to better understand this phenomenon. Our model has the advantage of being a simple explanation to understand and to express mathematically.

The classic equations of electricity do not try to give any explanation of the source causing the electrostatic force. It does not say how the charges are being attracted or repelled. It only quantifies the phenomenon.

We are convinced that, soon, it will be possible to explain the other great forces of the universe using the same concept of thermodynamic radiation pressure.

5. REFERENCES

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