Lorentz perpendicular action experiment and Lorentz force law

Peng Kuan 彭宽 titang78@gmail.com
27 February 2013

I have done an experiment that shows that magnetic force does not respect the Lorentz force law in the magnetic field of a narrow magnet. The video of this experiment is under this link: http://youtu.be/iIwtRV9HFTY
The presence of current in the test coil is indicated by the light of the led and the test coil turns only when the led is on. For more detail, please see the following article:
Success of the modified Lorentz perpendicular action experiment, blogspot academia

I will explain the experimental result and the revealed flaw of the Lorentz force law.

Experimental torque

First, let us compare the theoretical prediction by the Lorentz force law with the experimental result. In Figure 1, the test coil is represented by the square coil carrying the current **I** placed in the magnetic field **B**. The experiment shows that, in the magnetic field of the magnet, the test coil turns about the x axis (part (a) in Figure 1), but not about the y axis (part (b) in Figure 1).

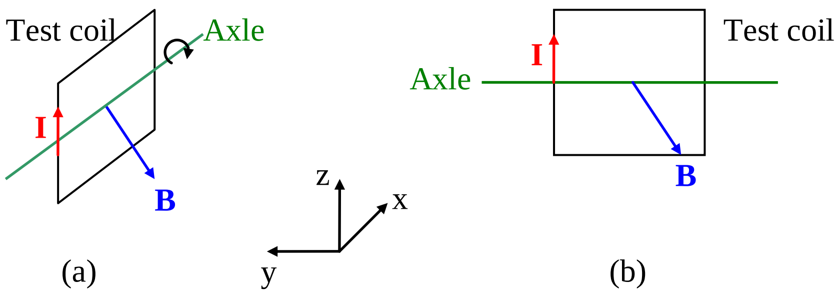

Figure 1

The Lorentz force law gives the magnetic force as follow:

$$\mathbf{F} = \mathbf{I} \times \mathbf{B} \cdot \Delta l \tag{1}$$

where Δl is the length of a segment of current.

Let us express the 3 components of the magnetic field in the referential of the test coil (see Figure 2) and define **f** as the magnetic force density:

$$\mathbf{f} = \mathbf{I} \times \mathbf{B} = \mathbf{I} \times B_x \mathbf{i} + \mathbf{I} \times B_y \mathbf{j} + \mathbf{I} \times B_z \mathbf{k} \tag{2}$$

The torque about the axle of the test coil is $\boldsymbol{\tau}$:

$$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F} \tag{3}$$

where **r** is the length of lever, which is the distance from the axle to the point of application of the force.

Let us study the torques that the 3 components of the magnetic field act on the test coil (see Figure 2). In part (a) of Figure 2, the i component B_i exerts a force on each vertical side of the test coil, f_1 and f_3, which are in the j direction. f_1 and f_3 are opposed and cancel out when computing the torque, so, the torque on the axle is 0:

$$\tau_i = r \cdot (f_1 + f_3)\ \Delta l,\ f_1 + f_3 = 0 \rightarrow \tau_i = 0 \tag{4}$$

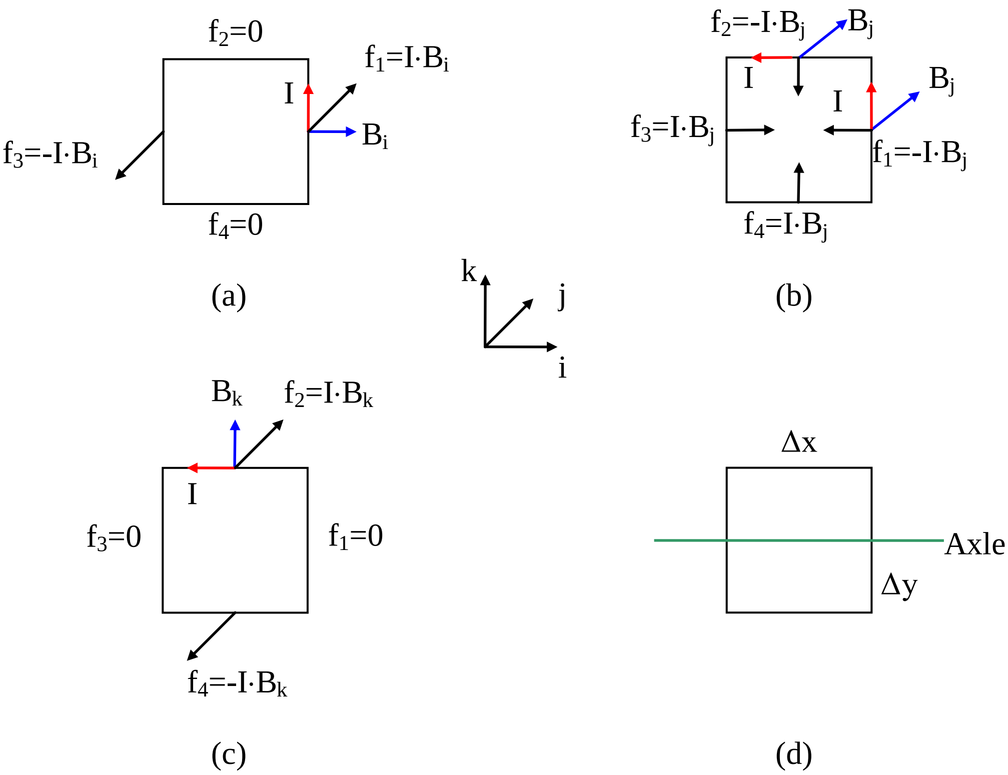

Figure 2

In part (b) of Figure 2, the j component B_j exerts a force on all sides of the test coil, but the 4 forces f_1 , f_2 , f_3 and f_4 are in the plan of the coil, so r=0, and the torque on the axle is 0:

$$\tau_j = (r_1 \cdot f_1 + r_2 \cdot f_2 + r_3 \cdot f_3 + r_4 \cdot f_4)\,\Delta l,\ r_1 = r_2 = r_3 = r_4 = 0\ \rightarrow \tau_j = 0 \qquad (5)$$

In part (c) of Figure 2, the k component B_k exerts a force on each horizontal side of the test coil, f_2 and f_4, which are in the j direction. The length of lever r is the half height of the test coil, r= Δy/2. The length of the current segment is Δx. So, the torque on the axle is:

$$\tau_k = r \cdot (f_2 - f_4)\,\Delta l,\ r = \Delta y/2,\ f_2 - f_4 = 2I \cdot B_k\ ,\ \Delta l = \Delta x \qquad (6)$$
$$\rightarrow \tau_k = \Delta x\ \Delta y \cdot I \cdot B_k$$

We see that only the k component B_k exerts a torque on the axle. Equation (6) shows that when the test coil rotates about the z axis, the torque is constant because B_k is the same. So, for the Lorentz force law, if the test coil turns about one axis, it must turn about all axes in the plan. For the Lorentz force law, there cannot be magnetic field that makes the test coil turn about the x axis but not about the y axis. However, this is exactly what the experiment shows, in clear contradiction with the Lorentz force law.

As experiment is the ultimate judge, we must conclude that the Lorentz force law is wrong.

Transversal force

The fact that the test coil does not turn about the y axis shows that the x component of the magnetic force on the horizontal sides of the test coil is 0, that is, F_x=0 (see Figure 3). What does this mean? Figure 3 shows the disposition of the test coil with respect to the magnet. F_x

is an interaction force between the magnet and the coil, which is transported through vacuum along the lines joining all points of the magnet to the test coil. As the magnet is along the z direction, and the test coil is located at a distance in the y direction, all these lines are in the plan yz. Thus, F_x is perpendicular to the paths of transmission of force. The fact that F_x=0 means that magnetic field does not transport forces perpendicular to the transmission path.

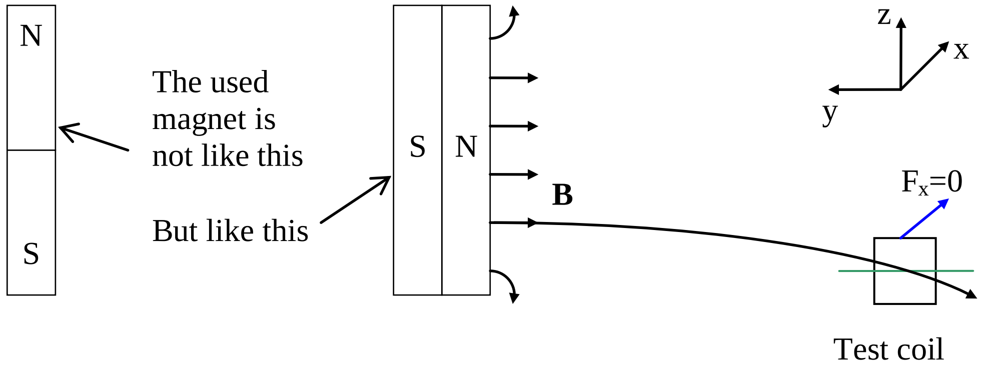

Figure 3

The Lorentz force law has this weird property to be always perpendicular to the current. In Figure 4, the forces between the 2 current elements I_1 and I_2 are $\mathbf{F}_{12}$ and $\mathbf{F}_{21}$. $\mathbf{F}_{12}$ is perpendicular to the radial vector **r**, signaling that transversal force should be transported. My experiment proves that this is impossible and that magnetic force respects in fact Newton's third law. By violating the latter, the Lorentz force law cannot be right.

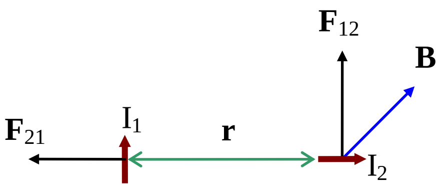

Figure 4

Equilibrium position

At equilibrium, the torque about the axle is 0. The experiment shows that the test coil is completely horizontal at equilibrium (please see the video). This position is shown by the horizontal bar 'b' in Figure 5.

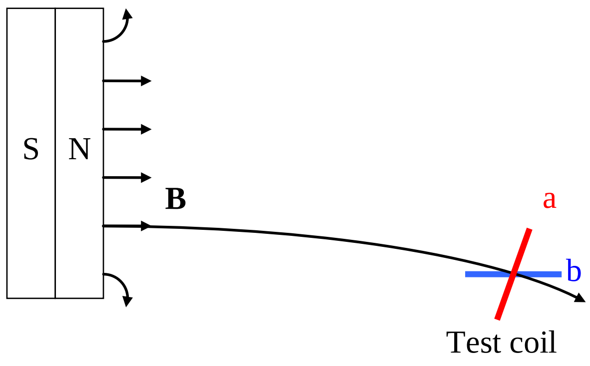

Figure 5

According to the Lorentz force law, we must have $B_k=0$ from equation (6). That is, the magnetic field vector should be perpendicular to the plan of the test coil and this position is shown by the bar ‘a’ in Figure 5. But this is invalidated by the experiment. So, the Lorentz force law predicts wrong magnitude of force here.

Comment

I call experimenters to redo this experiment and publish your report. As this experiment has already succeeded and breaks down the Lorentz force law, your paper will have good chances to be accepted.

What is ironical is that I can not make my papers published. The electromagnetic theory is so strongly installed that nobody imagines that it can be wrong. My articles are rejected by all journals and every people to whom I presented my theory rebuffed me. To promote my theory is such a hard battle that I feel to be in a war of lonely me against the whole world.

This is why I have decided to publish my theory on the internet one year ago. The last year was for me to find the right way to explain my theory and finally, I have designed this experiment and carried it out. Now, the theory becomes reality with this experiment and one can see with his proper eyes the flaw of the Lorentz force law.

One can ask, it is so hard to promote this theory and I am so lonely, why am I keeping doing this? My answer is that I believe firmly that Newton’s third law is the highest law and all forces transmitted through vacuum must respect it. The sheer fact that the Lorentz force law violates it signals it is wrong. It remains to find what the flaw is and to create a new theory to correct it.

Now, my experiment has proven that magnetic force respects Newton’s third law, my theoretical studies have proven that the Lorentz force law is mathematically inconsistent (please follow the links of the documents in **Summary**: blogspot, Academia). In a next article I will show how my correct law explains the result of this experiment. Before, you can learn about my correct law here:
Correct differential magnetic force law, blogspot academia