

1. A strange magnetic force

Here is a strange experiment. I made 2 magnets act a magnetic force on a current in the position shown in Figure 1. The 2 magnets stand vertically and generate the magnetic field \mathbf{B} . The current \mathbf{I} passes in a wire at some distance in front of them.

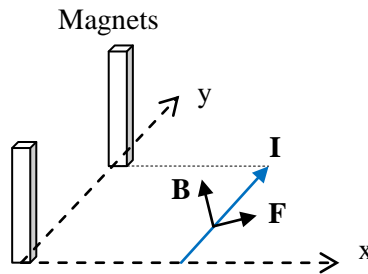


Figure 1

What is the force predicted by the Lorentz force law? Figure 2 shows the overhead view of the setup. In part (1), the current I_1 flows rightward and the magnetic force ΔF_1 points upward. In part (2), the current is reversed and flows leftward. So, the magnetic force ΔF_2 must point downward:

$$\begin{aligned}\Delta F_1 &= I_1 \times \mathbf{B} \cdot \Delta l \\ \Delta F_2 &= I_2 \times \mathbf{B} \cdot \Delta l = -\Delta F_1\end{aligned}\tag{1}$$

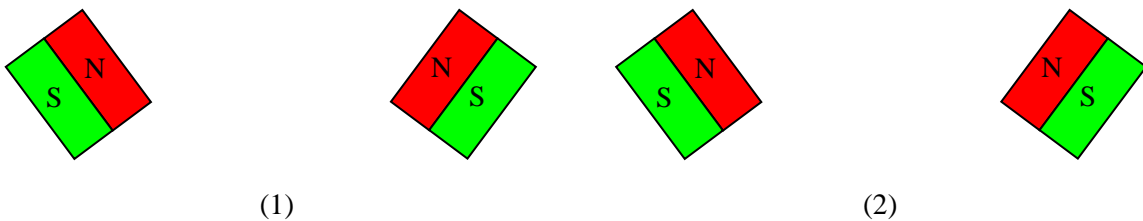


Figure 2

But in my experiment, when the current is reversed, the force does not reverse but becomes zero.

Figure 3 is a photograph of the setup and the video of this experiment is here

<http://youtu.be/WGLE8-7SpU>

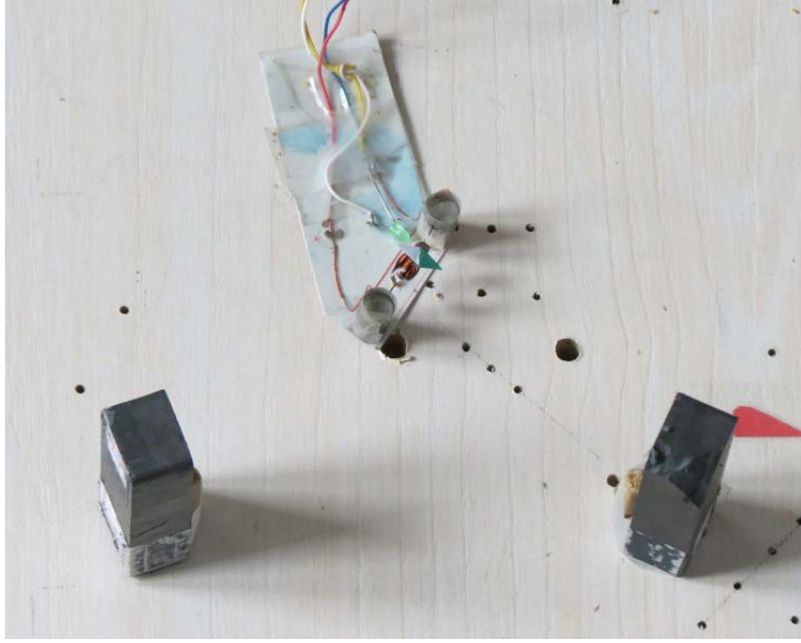


Figure 3

In the experiment, the presence of current is indicated by the led. When the led lights up, the current is on in the test coil and it should rotate. Figure 4 shows schematically the experiment.

Part (1): The current flows clockwise, the test coil rotates under the magnetic force F_1 .

Part (2): The current flows counterclockwise, the test coil stays still showing that there is not magnetic force at all.

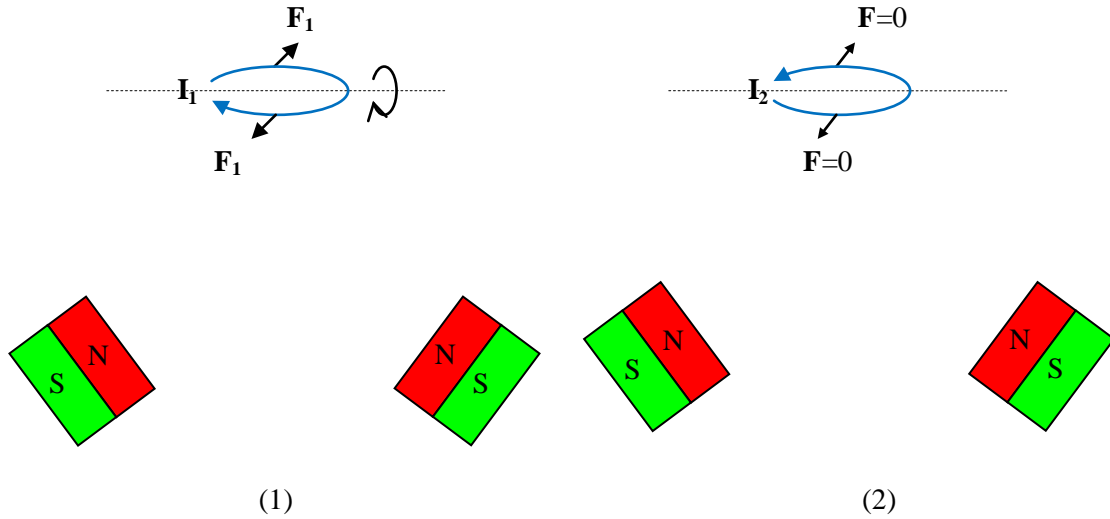


Figure 4

How can that be? Even with the tensor approach, the force should not reduce to zero. In the formula below, $[M]$ is the magnetic field tensor, $[I]$ is the current tensor:

$$\begin{aligned}\Delta F_3 &= [I][M]\Delta l \\ \Delta F_4 &= [-I][M]\Delta l = -\Delta F_3\end{aligned}\tag{2}$$

Does someone have an idea about what is going on? In order to help your thinking, I have computed the magnetic field lines and have drawn them in 3-dimension in Figure 5.

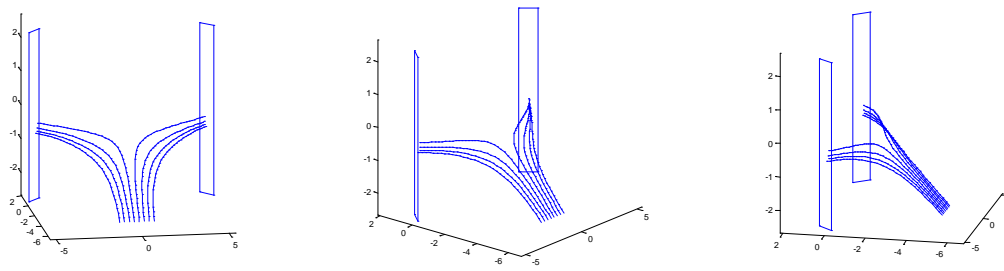


Figure 5 Magnetic field lines of the 2 magnets

2. Comment

This time, I do not give the explanation. Not because I do not have one, but because it comes from the theory of magnetization of wire, which nobody knows. There is no point to explain a new phenomenon to someone using a theory he does not agree with. If we try to explain to Aristotle that wood falls at the same speed as iron, he will never agree because he does not know Galileo's theory.

Aristotle believes that wood is lighter than iron and should fall more slowly than iron. This is common sense to him. Because of his common sense, he will not accept the explanation using Galileo's theory. The only way we can convince him is to bring him beneath the Leaning Tower of Pisa, then we tell Galileo to release the wooden ball and iron ball from the top of the tower and then, "Boom!"

We will say to Aristotle: "You see? The wooden ball and the iron ball arrive at the same time. So they fall at the same speed."

If he does not agree, we bring him to the top of the tower and let him release the two balls, that is, to perform the experiment himself. If he still does not agree, we push him down with the two balls. This way, he will see the two balls falling at the same speed with him during the fall. No, we do not want to kill him, he died 2 000 years earlier.

The Lorentz force law is common sense to physicist. I have heard many people asserting that I am wrong. Common sense is the greatest obstacle to progress. So, the most important thing to do now is to show the wrongness of the Lorentz force law by doing multiple experiments from all over the world. This way, the physical community will be forced to agree that yes, the Lorentz force law is wrong. Only then, physicists will begin to discuss the new theory and the professional journals accept to publish papers contradicting the Lorentz force law. Without breaking the stone wall of common sense, the improvement of the electromagnetic theory will never start.