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# A formalized method for finding real magnetic monopole and charge

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**Abstract**

It is shown that magnetic monopole and charge exist. Charge is a physical object that creates a force field and interacts with other charges of the same physical nature. Magnetic charge, like electric and gravitational, is located in the numerator of the formula for the force of magnetic interaction. Magnetic charge is equal to $I d\mathbf{l}$. It is this value that creates a force (magnetic) field. It is this value that interacts with other similar values. Therefore, it is this value, in accordance with the above definition, that is the magnetic charge.

*Keywords:* magnetic monopole, magnetic charge, electric charge, gravitational charge, electron.

Attempts to obtain a magnetic monopole by cutting a magnet into two parts have not been successful. Magnetic monopoles have not been found in space, in ores, in meteorites, in lunar soil, in experiments at the Large Hadron Collider [1]. Nowhere.

Abstract models of the magnetic monopole of Dirac, Hooft-Polyakov, Urutskoev, and others have remained abstract [2-4]. They have not been found in nature [5, 6].

However, magnetic monopoles and charges do exist.

The purpose of this work is to detect them.

To do this, it is enough to just look at other charges.

A charge is a physical object that creates a force field and interacts with other charges of the same physical nature [7].

The electric charge ($q_1$, $q_2$) [8] is located in the numerator of the formula for the force of interaction of electric charges

$$\mathbf{F}_{12} = \pm \frac{1}{4\pi\varepsilon_0\varepsilon} \frac{q_1 q_2}{r_{12}^3} \mathbf{r}_{12},$$

where ε is the relative permittivity, $\mathbf{r}_{12}$ is the radius vector.

Gravitational charge ($m_1$, $m_2$) [9]. is located in the numerator of the formula for the force of gravitational interaction

$$\mathbf{F}_{12} = -G \frac{m_1 m_2}{r_{12}^3} \mathbf{r}_{12},$$

where $G$ is the gravitational constant.

The magnetic charge, like the electric and gravitational charge, is located in the numerator of the formula for the force of magnetic interaction [10]

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$$d\mathbf{F}_{12}=-\frac{\mu_0\mu}{4\pi}\frac{(I_1 d\mathbf{l}_1, I_2 d\mathbf{l}_2)}{r_{12}^3}\mathbf{r}_{12}, \qquad (1)$$

where $\mu_0$ is the magnetic constant, $\mu$ is the relative magnetic permeability, $I_1$, $I_2$ are the electric currents in the conductors, $d\mathbf{l}_1$, $d\mathbf{l}_2$ are the elements of the interacting conductors with the currents.

A similar formula was obtained by Ampere.

Thus, the magnetic charge is equal to

$$d\boldsymbol{\mu}=Id\mathbf{l}, \qquad (2)$$

It is this quantity that creates a force (magnetic) field. It is this quantity that interacts with other similar quantities. Therefore, it is this quantity that, according to the definition given above, is a magnetic charge.

Universal representation

$$d\boldsymbol{\mu}=Id\mathbf{l}=\frac{dq}{dt}d\mathbf{l}=\frac{d\mathbf{l}}{dt}dq=\mathbf{v}dq.$$

$$\boldsymbol{\mu}=q\mathbf{v}, \qquad (3)$$

where **v** is the speed of the electric charge (see the theorem proved above).

Its universality lies in the fact that it is also suitable for individual particles.

For an electron:

$$\boldsymbol{\mu}_e=-e\mathbf{v}, \qquad (4)$$

where $e$ is the charge of the electron.

As a consequence, the Lorentz force is equal to

$$\mathbf{F}_L=[\boldsymbol{\mu},\mathbf{B}].$$

where **B** is the magnetic induction.

A strict derivation of formula (1) is beyond the scope of this discussion, but its fundamental structure can be verified by the following reasoning.

There are two parallel elements of conductors with currents (magnetic monopoles with charges $I_1 d\mathbf{l}_1$ и $I_2 d\mathbf{l}_2$) (Fig. 1).

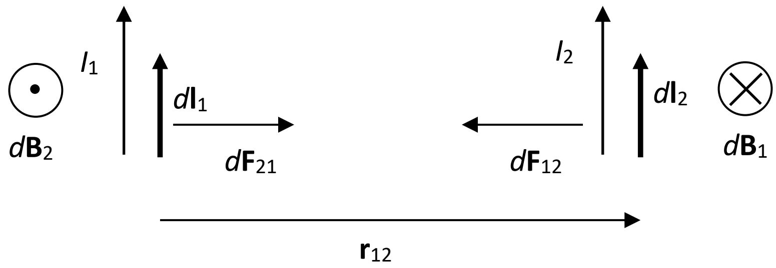


Fig. 1. Interaction of magnetic monopoles.

Magnetic charge $I_1 d\mathbf{l}_1$ creates a magnetic field with induction at the location of magnetic charge $I_2 d\mathbf{l}_2$

$$d\mathbf{B}_1=\frac{\mu_0\mu}{4\pi r_{12}^3}I_1[d\mathbf{l}_1,\mathbf{r}_{12}].$$

The force acting on the second charge from the magnetic field is equal to

$$d\mathbf{F}_{12}=I_2[d\mathbf{l}_2,d\mathbf{B}_1]= \qquad (5)$$

$$=\frac{\mu_0\mu I_1 I_2}{4\pi r_{12}^3}[d\mathbf{l}_2,[d\mathbf{l}_1,\mathbf{r}_{12}]]=-\frac{\mu_0\mu}{4\pi}\frac{(I_1 d\mathbf{l}_1, I_2 d\mathbf{l}_2)}{r_{12}^3}\mathbf{r}_{12}.$$

Coincides with (1).

Textbook magnetostatics does not satisfy Newton's third law (Fig. 2).

Really,

$$d\mathbf{F}_{12} = I_2\left[d\mathbf{l}_2, d\mathbf{B}_1\right] = \frac{\mu_0\mu I_1 I_2}{4\pi r_{12}^3}\left[d\mathbf{l}_2,\left[d\mathbf{l}_1,\mathbf{r}_{12}\right]\right] \neq 0,$$

$$d\mathbf{F}_{21} = I_1\left[d\mathbf{l}_1, d\mathbf{B}_2\right] = \frac{\mu_0\mu I_1 I_2}{4\pi r_{12}^3}\left[d\mathbf{l}_1,\left[d\mathbf{l}_2,\mathbf{r}_{12}\right]\right] = 0.$$

Here

$$\left[d\mathbf{l}_2,\mathbf{r}_{12}\right] = 0,$$

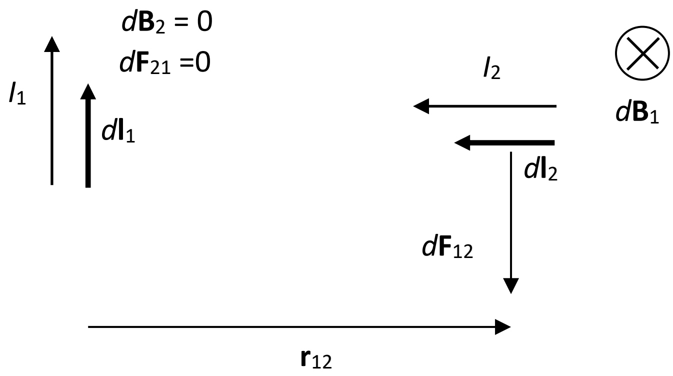


Fig. 2. Violation of Newton's third law

since the vectors are collinear.

Magnetostatics, constructed on the basis of expression (1), is completely consistent, including, it unconditionally satisfies Newton's third law [10].

*Note 1*. Ampere constructed magnetostatics on the basis of an expression similar to (1) (his formula differed only in the dimensionless coefficient) and declared the necessity of fulfilling Newton's third law.

*Note 2*. Expression (5) is not Ampere's law. He does not have a single expression resembling this formula.

The magnetic monopoles (2)-(4) found have nothing in common with the monopoles of Dirac, Hooft-Polyakov, Urutskoev, etc. Moreover, the monopoles of Dirac, Hooft-Polyakov, Urutskoev, etc. do not exist in nature. And monopoles (2)-(4) exist wherever there are moving electric charges, i.e., practically everywhere.

The theoretical significance of the work lies in the fact that the discovery of magnetic monopoles and magnetic charges improves the formal symmetry of electrodynamics, the violation of which has often worried many specialists.

The practical significance of the study lies in the fact that the overwhelming majority of processes in electrical systems are determined by magnetic charges.

**Conflict of Interest**

The author of the article declares that at the time of submitting the article to the editor, he has no possible conflict of interest with third parties

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## Формализованный способ отыскания реальных магнитных монополя и заряда

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**Аннотация**

Показано, что магнитные монополь и заряд существуют. Заряд — это физический объект, создающий силовое поле и взаимодействующий с другими зарядами той же физической природы. Магнитный заряд, как электрический и гравитационный, располагается в числителе формулы для силы магнитного взаимодействия. Магнитный заряд равен $Id\mathbf{l}$. Именно эта величина создает силовое (магнитное) поле. Именно эта величина взаимодействует с другими подобными величинами. Следовательно, именно эта величина, в соответствии с приведенным выше определением, является магнитным зарядом.

*Ключевые слова:* магнитный монополь, магнитный заряд, электрический заряд, гравитационный заряд, электрон.