MAGNETIC MONOPOLE THEORY

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Abstract: *The principal objective of this paper is, finding a way to discover magnetic monopole or an isolated magnetic charge in a theoretical manner. This paper discusses only theory with the support of Special Theory of Relativity. In future, if we found magnetic monopole, this theory is unaltered. In this theory I state Gauss law for magnetic charge. So, I modify Maxwell's equation by using Gauss law and mathematical procedure called Gauss divergence theorem. The result of this paper gives Equivalence of coulombs and webers.*

Keywords: *Magnetic charge, Special Relativity, Maxwell's 2nd equation, Coulomb and weber equivalence, Gauss law for magnetic charge.*

1. INTRODUCTION

Its known fact that, magnetic monopole not yet found! Is it possible to find magnetic monopole theoretically? Based on this question I develop magnetic monopole theory. This theory is like axiom which remains unaltered in future on practical evidence of having magnetic monopole. So, let found it theoretically:

1.1.Postulate of Magnetic Monopole Theory:

"Assume an electron is magnetic monopole as a result of Special theory of relativity!" You may take positive electric charge or negative electric charge in place of electron.

I have drawn this postulate from Special Theory of Relativity. Its known fact that, 'the relation between the magnetic and electric force was not fully understood until Einstein had constructed the Special theory of Relativity'. Based on this statement I develop Magnetic Monopole Theory. We have seen how magnetic force appears as a result of an electrostatic force and the special theory of relativity. Special theory of relativity demonstrates that a force which is identified as electrostatic in one frame of reference is observed as a magnetic force in another frame! In other words, the electric and magnetic force are really the same[5]. What an observer names it depends upon his state of motion.

Now here my question is; with the support of Special relativity;

If electric and magnetic force are really the same, then, what's wrong if I assume electric charge as magnetic charge? (Or) what's wrong if I assume a charge which is identified as electric in one frame of reference is observed as a magnetic charge in another frame? I think it's nothing wrong. Because, Special theory of relativity clearly says, '*a force which is identified as electrostatic in one frame of reference is observed as a magnetic force in another frame*[5]'. If it is magnetic force in another frame means, I assume the charge should be magnetic. By this assumption I construct theory of having magnetic monopole.

The result of this postulate removes conflict. There are two conflicting units in use for magnetic charge [Q_m] Webers [Wb] and ampere-meters [A-m][4]. In this theory I remove this conflict by showing magnetic charge will be measured in Webers (Wb).

2. THE EQUIVALENCE OF COULOMBS AND WEBERS

Let us find magnetic charge and its units;

Electric field strength is defined as electric force per electric charge[2][3].

$$E = \frac{F_e}{q_e} \tag{1}$$

Where,

E = electric field strength.

F_e = electric force.

q_e = electric charge.

In a similar way I can say Magnetic field strength (H) is defined as magnetic force per magnetic charge or magnetic monopole.

$$H = \frac{F_m}{unknown} \tag{2}$$

Let us denote this unknown quantity as a magnetic charge.

Magnetic charge or magnetic monopole = Q_m

We know that[2][3],

$$F_m = q_e B v_e \tag{3}$$

Where,

F_m = magnetic force.

q_e = electric charge.

B = magnetic flux density.

v_e = velocity of electric charge.

$$equation(3) \Rightarrow B = \frac{F_m}{q_e v_e} \tag{4}$$

We know that,

$$B = «_o H \tag{5}$$

Where,

H = magnetic field intensity or magnetic field strength.

$«_o$ = Magnetic permeability of free space or air.

By substitute equation (5) in equation (4),

$$H = \frac{F_m}{«_o q_e v_e} \tag{6}$$

By comparing equation (2) with equation (6),

$$unknown = Q_m = «_o q_e v_e \tag{7}$$

At rest $v_e = 0 \Rightarrow Q_m = 0$

Equation (7) is what an observer names an electric charge upon his state of motion. To get the equivalence of coulombs and webers I replace velocity of electric charge with speed of light (c) in vacuum.

Why I replaced velocity of electric charge with speed of light (c) in vacuum? Because it works practically. And this replacement unifies coulombs with webers.

Therefore,

$$Q_m = «_o q_e c \tag{8}$$

By substituting the values of magnetic permeability, charge of electron, and speed of light in equation (8) we get,

$$Q_m = 6.035884407 \times 10^{-17} \text{ Webers.}$$

Therefore magnetic charge will be measured in webers (Wb) not in ampere-meters.

$$\Rightarrow q_e = \frac{Q_m}{«_o c} \quad (9)$$

Since,

$$c^2 = \frac{1}{«_o £_o} \quad (10)$$

By substituting equation (10) in equation (9)

$$q_e = £_o Q_m c \quad (11)$$

$£_o$ = permittivity of free space (a vacuum).

Now I want charge of an electron. To get charge of an electron, substitute Magnetic monopole (Q_m=6.035884407*10^-17) in equation (11).

Therefore by substituting permittivity, magnetic charge (Q_m=6.035884407*10^-17), and speed of light in equation (11) we get,

$$q_e = 1.602176462 \times 10^{-19} \, coulombs$$

Equations (8 & 11) are considered as "the equivalence of coulombs and webers" or "the equivalence of electric flux and magnetic flux" or "the equivalence of electric charge and magnetic charge".

Equation (7) is considered as "changing electric charge gives magnetic charge".

Let us frame one problem to understand these equations clearly;

Problem 1: we know that current carrying conductor constitutes magnetic field around it. Now for suppose 10 amperes of electric current is flowing through a conductor and the length of the current carrying wire is 10 meters. Then;

a. How much magnetic charge associated with that conductor or current carrying wire?
b. What is the equivalence of electric charge of that associated magnetic charge?

Solution:

Given; I = 10A

L = 10m

a. Magnetic charge associated with that conductor; $Q_m = «_o q_e v_e = «_o IL = BA =$ Magnetic flux.

Where, $B = «_o H$
$A = area$

Q_m= 1.2568*10^-4 webers.

b. Equivalence of electric charge is; $q_e = £_o Q_m c$ = 3.335*10^-7 coulombs.

(This problem 1 is analogous to;

a. Calculating kinetic energy of a body having mass 2kg and moving with a velocity 10m/s.

$K.E = \frac{1}{2}mv^2$ Joules.

b. Calculate equivalence of mass of that kinetic energy.

$m = \frac{E}{c^2}$ Kg)

3. GAUSS LAW FOR MAGNETIC CHARGE

3.1.Magnetic displacement density or magnetic flux density $(\overline{B})$

Similar to electric flux density, Magnetic flux per unit area is called magnetic flux density.

$$\overline{B} = \frac{Q_M}{4®r^2} \tag{12}$$

3.2.Gauss law for magnetic flux $\cdot_M$

Statement: Magnetic flux coming out of a magnetic charged body is equal to the amount of magnetic charge enclosed.

$$\cdot_M = Q_M$$

Consider a point magnetic charge Q_M kept at the origin as shown in figure (1). Let us consider infinitesimal area ‘ds’ at a distance ‘r’ meters from the origin. The magnetic flux density and area vector $\overline{ds}$ are normal to the surface ‘ds’ as shown in figure (1). Let the flux crossing the surface ‘ds’ be $d\cdot_M$.

Note: on my assumed theory I drawn figure (1) for point magnetic charge at the origin.

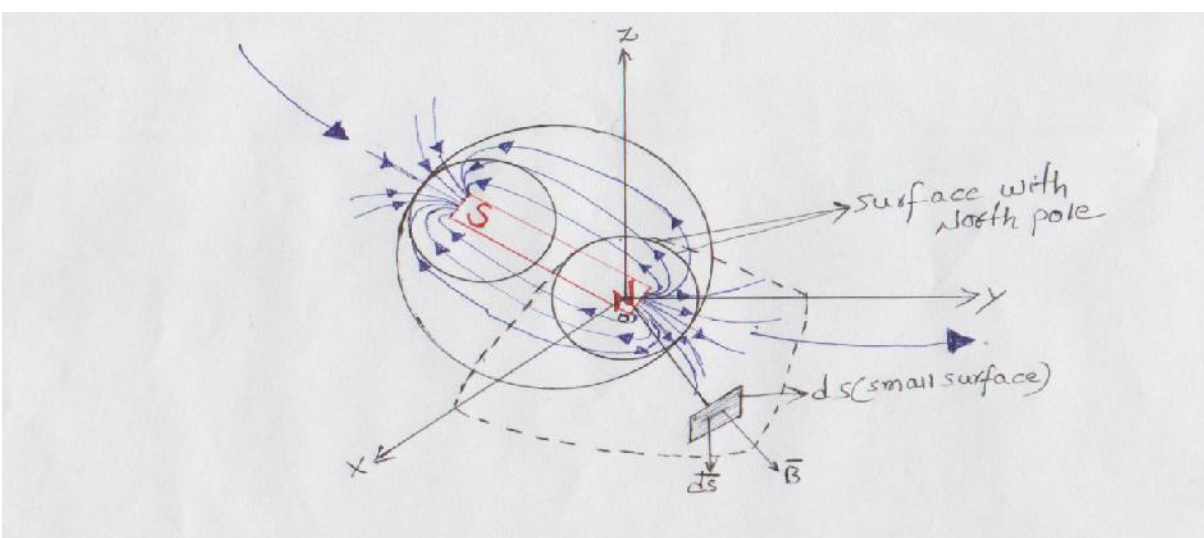

Figure 1: representation of Gaussian surface about a point magnetic charge at origin.

$$\overline{B} = \frac{d \cdot_M}{\overline{ds}}$$

$$\Rightarrow d \cdot_M = \overline{B}\,\overline{ds}$$

$$= Bds \cos ^{-}$$

$$\Rightarrow d \cdot_M = Bds \qquad (13)$$

Since $\overline{B}$ and $\overline{ds}$ are in same direction

The total flux leaving the entire surface can be obtained by surface integration,

$$\cdot_M = \int_s Bds \qquad (14)$$

By substitute equation (12) in equation (14) we get

$$\cdot_M = \iint \frac{Q_M}{4\text{®}r^2} ds$$

$$\Rightarrow \cdot_M = \frac{Q_m}{4\text{®}r^2} \iint ds$$

$$\Rightarrow \cdot_M = \frac{Q_m}{4\text{®}r^2} Area$$

We know that surface area of spherical surface of radius ‘r’ is $4\text{®}r^2$

Therefore, $\cdot_M = Q_M$ (15)

3.3.Modified Maxwell’s Equation:

Let $°_{MV}$ be volume magnetic charge density.

If the body is uniformly charged with the magnetic charge density $°_{MV}$. Total charge is given as follows.

$$Q_M = \rho_{MV}\, volume = \rho_{MV} \int_V dV$$

$$Q_M = \int_V \rho_{MV}\, dV$$

By gauss law or from equation (14) and (15)

$$\int_s B ds = \int_V \rho_{MV}\, dV \qquad (16)$$

Gauss divergence theorem relates surface integral and volume integral [2]. According to Gauss divergence theorem surface integral of normal component of the magnetic flux density is equal to the volume integral of divergence of ‘B’.

$$\int_s B ds = \int_V \nabla \cdot B dV \qquad (17)$$

By substitute equation (17) in equation (16) we get

$$\int_V \nabla \cdot B dV = \int_V \rho_{MV}\, dV$$

$$\Rightarrow \nabla \cdot B = \rho_{MV} \qquad (18)$$

$\nabla \cdot B = \rho_{MV}$ is modified Maxwell’s 2nd equation.

Note: For suppose, if an isolated magnetic monopole is discovered in our laboratories then also equation (18) cannot be altered.

3.4.Magnetic force between two magnetic charges or between two current carrying wires:

$$F_m = \frac{Q_{m1} Q_{m2}}{4\pi\mu_o r^2} = \mu_o \frac{I_1 dl_1 I_2 dl_2}{4\pi r^2} \qquad (19)$$

3.5.Result table:

The significances of this paper is shown below in table 1.

Equation	Meaning
$Q_m = «_o q_e v_e$	Changing electric charge gives magnetic charge.
$q_e = £_o Q_m v_e$	Changing magnetic charge gives electric charge.
$q_e = £_o Q_m c$ **(Or)** $Q_m = «_o q_e c$	Equivalence of coulomb and weber.
$\nabla \cdot B = °_{MV}$	Theoretical existence of magnetic charge or modified Maxwell's 2nd equation.

Table 1: resultant table of this theory

4. CONCLUSION

In this paper I developed theory for the existence of magnetic charge. The result gives new way of unifying electric flux and magnetic flux and equation for equivalence of electric flux and magnetic flux. This theory does not change present theory of electromagnetism. I just represented present theory of electromagnetism in a new way to prove theoretical evidence of magnetic charge.

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