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Moving Electron Is Magnetic Monopole

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Abstract: *By using existing theory we logically deduce moving electron or moving charge as magnetic monopole. So we derive Maxwell's 2^{nd} equation by considering moving charge as magnetic monopole and also we introduce new law called LAW OF NATURE 1 which unifies scalars and vectors. Since physics always seeks unification, so we unify scalars and vectors by using new law which is initiated from Maxwell's equations.*
Keywords: *Law of nature 1, Maxwell's 2^{nd} equation, moving charge, magnetic current density, monopole.*

I. Introduction

If electricity and magnetism are unified, then why can't we take moving charge as magnetic monopole? We know that, as long as a charge is at rest there is only an electrostatic field. But a magnetic field appears as soon as the charge begins to move. The faster the charge moves, the stronger the accompanying magnetic field. So it is logically very clear that source of magnetic field is moving charge. Practically magnetic field exists if and only if, both positive and negative charges are in motion. Since we know that conventionally direction of positive chargesis taken as direction of current and negative charges moves oppositely as shown in Fig 1. If moving charges are source of magnetic field and since charges are two types. So we are taking moving charge as magnetic monopole. Otherwise we should accept electricity is different from magnetism.

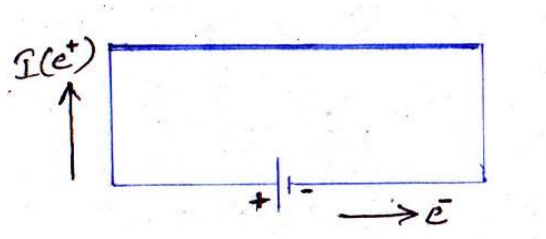

Figure 1: current element

II. Sources Of Magnetic Field

There are two types of sources
1) Bar Magnet

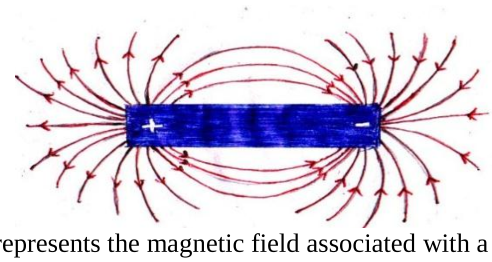

Figure 2: represents the magnetic field associated with a bar magnet.

2) Current element

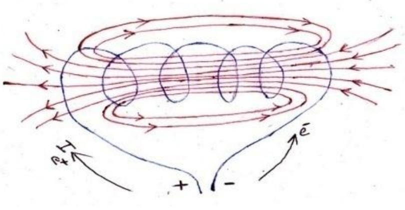

Figure 3: represents the magnetic field associated with the current flowing through a solenoid.

Magnetic field associated with a current carrying conductor also depends upon the direction of flow of current. If we change the direction of flow of current then the direction of poles of magnetic field is also changes. Here logic is whenever moving charges are changing direction then poles also changing direction. If poles are not changing the direction with respect to the direction of current then moving charge is not a magnetic monopole. But we know that whenever moving charges are changing direction then poles also changing direction. Therefore logically moving charge is magnetic monopole.

Motion of charged particles is current .which is changing electric field. Changing electric field associated with magnetic field. From this it is clear that moving charges constitute magnetic field. Current element behaves as bar magnet if and only if positive and negative charges are in motion or in simple current element having lower and higher potential.

Note: we know that magnetic properties of matter depend on motion of charged particles inside atom.

III. Mathematical Explanation

The force of attraction or repulsion between two magnetic poles is given by

$F= \frac{\mu M1M2}{4\pi r^2}\hat{a}$ (1)

M_1=M_2=magnetic pole strengths

The force of attraction or repulsion between two current elements is given by

$F =\frac{\mu I1dl1I2dl2}{4\pi r^2}\hat{a}$ (2)

I_1dl_1= I_2dl_2=current elements

Comparing (1) and (2)

$M_1=I_1dl_1$

$M_2=I_2dl_2$

Idl is source of magnetic field

Since $I = \frac{dq}{dt}$; $v = \frac{dl}{dt}$

$\therefore$ Idl = qv (3)

Therefore pole strength is product of charge and velocity of charge. The faster the charge moves, the stronger the accompanying magnetic field.

+qv and -qv attracts each other , +qv and +qv repels with each other.

IV. Maxwell's 2nd Equation

Flow of charges is nothing but current so Flow of magnetic monopoles is magnetic current.

4.1. Magnetic current density (K)

Magnetic current density (K) is directly proportional to electric current density (J)

$K \propto J$

$\Rightarrow$ K = μJ (4)

μ = proportionality constant called magnetic permeability

Magnetic current density (K) is also defined as magnetic flux per unit volume

$K = \frac{d\phi}{dv}= \mu J$ (5)

$\Rightarrow d\phi = \mu J dv$ (6)

After integrating both side of (6) we get

$\phi = \int \mu J\, dv$ (7)

4.2. Magnetic flux density (B)

It is defined as magnetic flux per unit area

$B = \frac{d\phi}{ds}$

$\Rightarrow d\phi = Bds$

$\Rightarrow \phi = \int Bds$ (8)

Comparing (7) and (8)

$\oiint Bds = \oiiint \mu J dv$ (9)

By using gauss divergence theorem

$\oiint Bds = \oiiint \nabla . Bdv$ (10)

Therefore from (9) and (10)

$\oiiint \nabla . Bdv = \oiiint \mu J dv$

$\Rightarrow \nabla . B = \mu J$ (11)

(11) Is Maxwell's 2nd equation by considering moving charge as magnetic monopole.

From ampere's law
$\nabla \times B = \mu J$ (12)

$$\Rightarrow \nabla \times B = \nabla . B$$

Note: For conduction current and displacement current follow modified ampere's law.
Comparing (11) and (12) both are same. So here we require or necessity to introduce new law called LAW OF NATURE 1.
Note:if $\nabla \times E = \nabla . E$ then above arguments, equations, and theory is correct otherwise up to now completely wrong.
So now we see $\nabla \times E = \nabla . E$ is correct or not.

4.3. Law of nature 1
It is stated as Divergence of any vector is equal to curl of that vector. If E is any vector then $\nabla \times E = \nabla . E$
Or$\nabla . E = \nabla \times E$
We know that divergence of a vector is scalar and curl of that vector is vector. From law of nature 1 both is equal. Therefore scalars and vectors are unified by using LAW OF NATURE 1.
Now we prove $\nabla . E = \nabla \times E$ is true or not.

From faraday's law$V = -\frac{\phi}{t}$ (13)
From relation between voltage and electric field is
$V=El$ (14)
From magnetic flux density $B = \frac{\phi}{l^2}$ (15)
From (13),(14),(15) we get
$B = -\frac{E}{v}$ (16)
B = magnetic flux density
E= electric field
v = velocity of charge
We know that $v\rho_v = \sigma E$ (17)
From (16) and (17)
$B = -\frac{v\rho_v}{\sigma}\left(\frac{1}{v}\right)$ (18)
Since $\rho_v = \frac{q}{l^3}$ (19)
$\Rightarrow B = -\frac{q}{\sigma l^3}$ (20)
Now $-\frac{\partial B}{\partial t} = -\left(-\frac{\partial q}{\partial t \sigma l^3}\right)$
$\Rightarrow -\frac{\partial B}{\partial t} = \frac{I}{l^{3\sigma}}$ (21)
We know that $I = \rho_v v l^2$
Therefore $-\frac{\partial B}{\partial t} = \frac{\rho_v}{\sigma t}$ (22)
We know that $\varepsilon = \sigma t$ (23)
Substitute (23) in (22) we get

$-\frac{\partial B}{\partial t} = \frac{\rho_v}{\varepsilon}$ (24)
From Maxwell's 4th equation $\nabla \times E = -\frac{\partial B}{\partial t}$ (25)
Comparing (24) and (25)
$\nabla \times E = \frac{\rho_v}{\varepsilon}$ (26)
From Maxwell's 1st equation
$\nabla . E = \frac{\rho_v}{\varepsilon}$ (27)
Therefore from (26) and (27)
$\nabla \times E = \nabla . E = \frac{\rho_v}{\varepsilon}$
Therefore we proved.

4.4. Continuity equation
From (4)$K = \mu J$
Take divergence on both sides $\Rightarrow \nabla . K = \mu \nabla . J$ (28)
Since$\nabla . J = -\frac{\partial \rho_v}{\partial t}$ (29)

Substitute (29) in (28) $\Rightarrow \nabla . K = -\mu \frac{\partial \rho_v}{\partial t}$

4.5. Relations

$$\nabla . B = \mu v \nabla . D$$
$$\nabla \times H = \varepsilon v \nabla \times E$$

V. Conclusion

The source of magnetic field is changing electric field. Changing electric field exists due to motion of positive and negative charges. Without moving charges it is impossible to unite electricity and magnetism. Based on this logic, we are taking moving charge as magnetic monopole. Since magnetic field associated with current element having North Pole and South Pole exists if and only if positive charges and negative charges are in motion. Since charges are two types, positive charge and negative charge. Therefore moving charge or moving electron is magnetic monopole.

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