IOSR Journal Of Applied Physics (IOSR-JAP)
e-ISSN: 2278-4861.Volume 12, Issue 3 Ser. II (May – June 2020), PP 46-49
www.Iosrjournals.Org

Magnetic Field around a Current carrying Conductor

Prof Oruganti Subba Rao
Hyderabad, Telangana State, India

Abstract: *This paper provides the reason for existence of magnetic field. Oersted Law states a relation between magnetic field and electric current. From the same law, a relation is derived between magnetic flux, electric flux and velocity. it has been established that the magnetic flux opposes the resultant vector of electric flux and velocity. The vector analysis demonstrates the reason for magnetic field being circular around conductor. This analysis proves magnetic field is not a fundamental field. The direction of electric field around charged particles is found to be opposite to what conventionally accepted. This analysis also provides clue to universal consciousness and wisdom.*

Keywords*: Magnetic field, fundamental field,*

Date of Submission: 20-05-2020 Date of Acceptance: 05-06-2020

I. Importance Of The Article

The importance of this article lies in re-interpretation of existing laws and phenomena to understand NATURE and its behavior.

Dependency of magnetic field on electric field demonstrates beyond doubt that Magnetic field is not a fundamental one but a tensor of rank three. A fundamental field is necessarily a tensor of rank one. It should exist on its own and should not depend on others for its existence.

Space around conductor is not vacuum. This suggests space, in general, is made up of fundamental particles constituting dark matter or energy surrounding the conductor.

The direction of Electric field around charged particles is opposite of what conventionally accepted. The electric field around electrons (negatively charged particles) is found to be radiating out from electrons. This implies the direction of electric field around proton is radiating in towards proton. The gravitational field around neutrons is also radiating in towards neutron. This observation is of utmost importance: this may be the reason protons and neutrons are held in nucleus. Further with the same logic, a neutron may be a cluster of neutrinos and a proton may be a positron surrounded by neutrinos. That is why a proton and a positron have same charge but different mass.

Behavior of space around the conductor provides a clue to define universal consciousness and universal wisdom

It is also observed that the intent of Lenz's law and Newton's third law of motion is to oppose an action. This means all the laws discovered so far need a rejig to understand the consistency of intent.

One such area, which needs attention, is related to Energy: Relation between kinetic energy and temperature (Kelvin), relation between Energy and mass (Einstein) and relation between energy and frequency (Max Planck). If energy cannot be created or destroyed and all forms of energy are interrelated, a better interpretation of these laws will help to identify the consistency of intent of these three laws.

II. Main Article

Existence of magnetic field around a current carrying conductor is known but the reason for its existence is not established till date. This paper investigates the reason for existence of magnetic field.

From Oersted's law $\psi \propto I$ …… (1)

Where ψ = magnetic field, I = strength of electric current

For a given electric conductor $V = I R$ ……..(2)

Where V = voltage applied across the conductor, R is resistance of conductor

As R is constant for a given conductor, equation (2) implies $V \propto I$

Here it should be observed that it is the V (voltage) applied across the conductor which dictates I (strength of current) to flow in the conductor. Since V can be manipulated, it is independent variable. I is dependent variable since it adjusts itself to the V applied across the conductor.

Hence for a given conductor, equation (1) can be written as

$\Psi \propto V$ …… (3)

For a given conductor $R = \rho \ell / A$ …… (4)

Where ρ = specific resistivity of the conductor, A = cross sectional area of the conductor

ℓ = length of the conductor

We know I = q/t …… (5)

Where q = amount of charge and t = time taken by the charge to flow through the conductor

From equations (2), (3), (4) and (5)

$\psi \propto (q/t)(\rho \ell / A) \Rightarrow \psi \propto \rho (q/A)(\ell/t) \Rightarrow \psi \propto \rho (q/A) v$….. (6)

Where v stands for velocity of charged particles = ℓ /t (length / time)

q/A stands for density of charged particles per unit cross sectional area

If e is the charge on an electron then q = ne where n is number of electrons and ~~e~~ q is ~~the~~ total charge ~~on electron~~. q/A literally represents density of electrons per unit cross sectional area.

Here we note for a given conductor for given applied voltage that

a) More is cross sectional area, more is the number of electrons, hence current will be more

b) Velocity of electrons depends on resistivity ρ and ρ is the property of the conductor. If ρ is more, velocity will be less and vice versa.

If F_e is the strength of electric field near charge, the $F_e \propto q$ …… (7)

From (6) and (7) we can derive $\psi \propto (F_e/A) \times v$ ……(8)

Here one should note that (F_e /A) represents Electric flux per unit area. Hence it is evident that ψ represents Magnetic flux per unit area.

From equation (8), it is evident that when electric flux moves, magnetic flux comes into existence. When magnetic flux moves near a conductor, electric flux moves which appears as current in the conductor. Lenz's law explains that direction of current is such as to oppose the movement of magnetic flux. From the same logic, it is evident that the magnetic flux is to oppose the resultant vector of electric flux and velocity.

First, we have to determine the direction of resultant vector of electric flux and velocity. The opposite of that will be the direction of magnetic flux.

For this, we have to determine the direction of flux around electron. By convention the direction of field around a positive charge is taken as radiating out from particle and for negative charge the direction of field is taken as moving into the particle. Similarly, the direction of magnetic field from North pole is treated as coming out from North Pole and direction of magnetic field as entering into South pole. These conventions were introduced to explain the attraction and repulsion behavior of electric / magnetic field.

As long as these fields are independent of each other, these conventions can be taken for granted. But if these fields are interdependent on each other as evident from equation (8), convention can be applied only one of the fields and the direction of the other field is to be ascertained.

A magnet roughly aligns itself with Earth's north pole and south pole, which serves as a reference. Based on this, the direction of magnetic field around a current carrying conductor is determined by right hand rule. Keeping the convention of direction of magnetic field as it is, we try to determine the direction of field on charged particles.

Electron carries negative charge. As per convention, the direction of electric field is towards particle. If we take this direction and analyze, the resultant magnetic field does not obey the right-hand rule for magnetic field around a current carrying conductor.

But if we consider, the electric field radiating out from electron, it can be proved that the resultant magnetic field obeys right hand rule.

Electric field is uniformly distributed around electron. Direction of electric field is considered asradiating away from centerof electron. We will consider one line of force for analysis as shown in Fig 1. The result of analysis will be extended to the entire electric field around electron.

F_{ev}

F_e

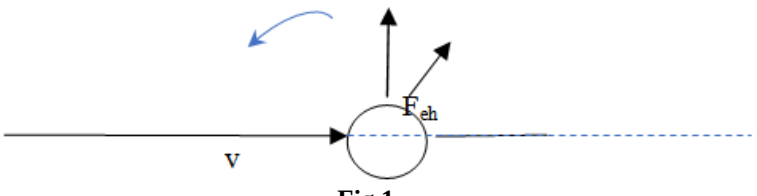

Fig 1

If we consider the line of action of vector v as x axis then plane perpendicular to x-axis will be y-z plane. Vertical Component of F_e is F_{ev}andwill lie in y-z plane. Horizontal component of F_e is F_{eh} and will lie along x-axis.Both these components will lie in a plane formed by the line of actions of vectors F_e and v.

if we consider all lines of electric field around an electron, the sum of horizontal components will be zero as 50% components will be on positive side of x-axis and 50% components will lie on negative side of x-axis. All vertical components will lie on y-z ~~axis~~plane.

Consider one such vertical component F_{ev}in y-z plane and vector v. As these vectors are perpendicular to each other, according to cross product of vectors, the resultant will be perpendicular to the plane containing F_{ev} and v. If these components lie in the plane of this paper, the resultant of these vectors will be perpendicular to this paper.
What is the direction of resultant vector? Is it upwards or downwards?
To resolve this, we take the case of torque.

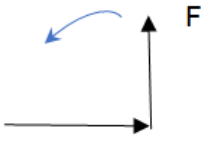

Fig 2

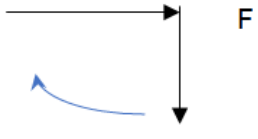

Fig 3

Fig2 represents force moves anticlockwise with respect to displacement vector.If these two vectors are on plane of paper lying on ground, the direction of resultant vector is upwards as this is considered the positive direction of resultant vector.
Fig3 represents force moves clockwise with respect to displacement vector. The direction of resultant vector is downwards as this is considered the negative direction of resultant vector.
Following the same convention, the direction of resultant vector in fig 1 will be upwards.

The picture of resultant vector,considerii~~i~~ng all vertical components of electric field lying in y-z plane~~,~~will be as shown in Fig 4below:

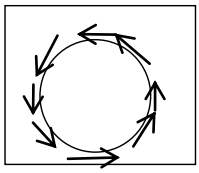

Fig 4- direction of resultant vector, Velocityperpendicular to paper &upwards

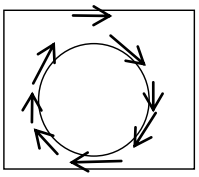
Fig 5- direction of magnetic field, Velocityperpendicular to paper &upwardsw.r.t. flow of electrons

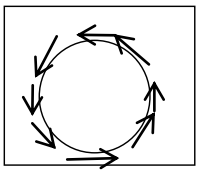
Fig 6- direction of magnetic field, Currentperpendicular to paper &upwardsw.r.t. current

The Fig 4 depicts resultant vector around the conductor with respect to the direction of velocity of electrons, which is perpendicular to plane of paper and upwards.
The direction of magnetic field will be opposite of resultant vector. Fig 5 shows the direction of magnetic field with respect to direction of motion of electrons, which is perpendicular to plane of paper and upwards.
But we know that direction of current is opposite of the direction of electrons.

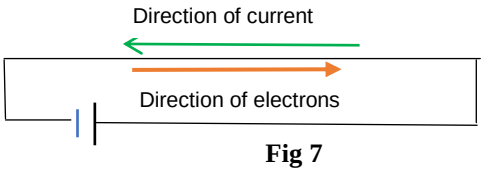

Fig 7

In fig 7, green line shows the direction of current and brown line represents direction of motion of electrons.
The direction of magnetic field is ascertained by right-hand rule is with respect to the directionof current only.
Fig 6 shows the direction of magnetic field with respect to direction of current, which is perpendicular to plane of paper and upwards. This is as per right hand Thumb rule for ascertaining direction of magnetic field.
This is the explanation why magnetic field is in circular loops around the current carrying conductor. Since electric field follows inverse square law, the magnetic field corresponds to electric field and follows inverse square law.

***The following are observed from the arguments given above*:**

1) Space around the conductor is not vacuum. Before current flows in conductor, no field is observed. With the flow of current, magnetic field comes into existence. This is possible if space is made up of particles carrying field. Normally they are in a state of equilibrium. When current flows in a conductor, they align themselves to oppose the vector. This suggests the presence of dark matter or dark energy.

2) This shows magnetic field is not a fundamental field, which can exist on its own. Magnetic field exclusively depends on three parameters namely strength of electric field, direction of electric field and velocity of electric field. Hence magnetic field is a tensor of rank three. On the other hand, electric field and gravitational fields depend upon particles having charge and mass respectively. Electric field depends on two parameters namely charge and curvature of space (inverse of distance), hence tensor of rank two. For a similar reason, gravitational field is also of rank two. This exemplifies that the tensor analysis provides a clue to fundamental field and hence to a fundamental particle. A tensor of rank one is the fundamental field as it requires only one parameter the direction of field. The particle which carries the fundamental field is fundamental particle. Is this fundamental particle a source of dark matter or energy?

3) Considering the convention for direction of Magnetic field as standard, the direction of electric field around electron is found to be radiating out from centre of electron as depicted in fig 1. It is just opposite of the direction conventionally followed. This implies the direction of field around positron will be radiating in towards centre of positron as the direction of field around positron is opposite to that of electron.

3) Two particles can be held together, as in case of formation of atoms and molecules, by fields only. In case of hydrogen molecule, two hydrogen atoms are held together by magnetic field. The fourth quantum number of Electron of one hydrogen atom is plus half spin and the same of other hydrogen atom is minus half spin. The electron in orbitals results into magnetic field. If one behaves as north pole, other behaves as south pole, hence the attraction. As the magnetic field is strong, they provide a strong bond. Covalent bonds are because of magnetic field.

4) When a hydrogen atom and Oxygen atom come together, electron of Hydrogen is transferred to Oxygen. The transfer of electron is owing to the magnetic field created by electrons in p-subshellof oxygen atom. This transfer of electron results in positive charge on Hydrogen and negative charge on Oxygen.Thus, ionic bond between Hydrogen and oxygen is due to electric field.

5) The direction of field around proton and neutron is radiating in towards in the respective particle.Itmay be the reason why nucleus of an atom contains neutrons and protons.

Using the same logic, a neutron may be a cluster of neutrinos and a proton may be a positron surrounded by neutrinos. That is why a proton and a positron have same charge but different mass.

As the direction of field around neutrino and electron are in different directions, formation of an anti-proton and hence existence of anti-matter is technically impossible.

6) Two protons are held in nucleus. Two electrons form a pair in super-conductor. This is against the law that similar charged particles repeal each other.

Further two similar charged particles repeal each other. Two similar magnetic poles repeal each other. But two similar mass particles attract each other. This is against the consistency of laws.

This shows attraction and repulsion between particles is not due to field but due to the space around the particles. Evidence of mass defect reinforce that space is not vacuum but an entity and it holds the key to behavior of particles and formation of an atom.

7) Lenz's law is used to determines the direction of current in a solenoid, which opposes the movement of magnetic flux. How does solenoid know a magnetic flux is moving around it? How does solenoid decide to oppose the magnetic flux? Similarly, how the space around the conductor experiences the flow of current in conductor? How the space around it decides to oppose it?

Here we have to bring Newton's first law of motion, Lenz's law and Newton's third law of motion together to understand space behavior. Newton's first law states a force causes a change of state. Lenz's law states Nature's ability to recognize the change of state. Newton's third law states Nature's ability to oppose a change of state. The three laws together define universal consciousness.

Newton's third laws states the response is measured one – just equal, not more and not less. This defines the universal wisdom.

This explicitly shows that space is not vacuum, but it is an entity which can respond to a change of state.

Prof Oruganti Ssubba Rao. "Magnetic Field around a Current carrying Conductor." *IOSR Journal of Applied Physics (IOSR-JAP)*, 12(3), 2020, pp. 46-49.