

On asymmetric electric force: deflection of a magnetic needle in a static electric field which varies in the direction perpendicular to its polarization

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Abstract— Motion of an electrical charged particle in a static electric field, which varies in the direction perpendicular to its polarization, is investigated. The field applies asymmetric electric force on the particle consequently the particle follows a curved path like in magnetic fields. Comparative study shows that motion of a charged particle in the selected static electric

field obeying equation $E(r) = -\hat{y} \frac{E_0}{r} = -\hat{y} \frac{E_0}{\sqrt{x^2 + z^2}}$ and motion of the same charged par-

ticle in static magnetic field produced by a straight long wire carrying a steady electric current are similar. It implies that the static asymmetric electric force and the static magnetic force are analogous to each other. Further the analysis shows deflection of a magnetic needle in the above static electric field due to the static asymmetric electric force and deflection of the same magnetic needle in the magnetic field of the straight long conductor carrying the steady electric current are precisely similar. It implies that the straight long conductor carrying a steady electric current might be producing a static electric field, parallel to the wire, decreasing in magnitude away from the wire, and having direction opposite to the current. Consequent of this a circular coil carrying a steady electric current and bar magnet too should produce a circular electric fields around themselves. Therefore, a circular electric force should be responsible to produce the illusion of attraction and repulsion between the magnetic poles consequently there might be no any direct force of attraction or repulsion between the poles of bar magnets. For experimental verification of static asymmetric electric force the required static electric field which varies in the direction perpendicular to its polarization can be produced by an electric dipole. A magnetic needle suspended in this field, at particular position and at particular angle, should get deflected giving confirmation of existence of the asymmetric electric force. Deflection of a magnetic needle in any static electric field is a surprising thing.

I. INTRODUCTION

Electrically charged particles, such as electrons and protons, are everywhere. In contrast, elementary particles with a net magnetic charge, predicted by Dirac [1], have never been observed despite intensive and prolonged searches [2-13]. Recently, some condensed matter systems showed a structure superficially similar to magnetic monopoles known as magnetic flux tubes. Ends of the tube form a dipole. The ends can move independently so they can be treated as independent magnetic monopole quasiparticles [14], however, not absolutely like predicted by Dirac. Consequently, no one could ever report about their right subsistence. History of magnetism reveals that, up to the 18th century, electricity and magnetism were treated independently. In 1820, Christian Oersted noticed deflection of a compass needle in the presence of a current-carrying wire. Obviously, that experiment compelled to believe that the current-carrying wire was producing a magnetic field which established a connection between electricity and magnetism. Reason behind the inference was that magnetic needle can get deflected only in magnetic fields. Its deflection in the vicinity of the current carrying wire forced to believe that the wire must be producing a magnetic field. The present theory of electromagnetism has been developed as a result of that conclusion. However, one could not find the existence of magnetic monopoles as expected. The belief that a magnetic needle can get deflected only in magnetic fields is accountable for all these ambiguities. Performing of deflection of a magnetic needle in any static electric field may compel to reinvestigate the theory of electromagnetism. It may reveal the secret of nonexistence of magnetic monopoles in the universe and the true nature of magnetic field and magnetic force too. In [15] study of asymmetric electric force is reported, however, it is quoted that for existence of asymmetric electric force only a curled electric field is essential which is not true. Further it states that a static electric dipole can produce a static curled electric field in a particular region which is false too. Aim of the present work is to remove these inconsistencies and put the theory into more consistent form.

II. ASYMMETRIC ELECTRIC FORCE

To verify existence of asymmetric electric force an electric field which varies in the direction perpendicular to its polarization is essential. A static parallel electric field (equation (1)) varying in the direction perpendicular to its polarization is more convenient.

$$\mathbf{E}(r) = -\hat{\mathbf{y}} \frac{E_0}{\sqrt{x^2 + z^2}} = -\hat{\mathbf{y}} \frac{E_0}{r} \quad (1)$$

A spherical charged particle having mass m , electric charge q with initial velocity \mathbf{v} in the direction of the field is placed to analyze the force as illustrated in Fig. (1). The force tries to increase the speed of the particle. Aim is to find, whether the particle follows a straight path or a curved path. For that one needs to divide the particle into two hemispheres and calculate force on each. Obviously these two forces will have same direction but of different magnitudes, and therefore the resultant force is asymmetric electric force, consequently the two hemispheres will travel unequal distances as a result of which the particle, as a whole, will go along a curved path. Clearly the size of the particle matters in

this method. To remove this dependency one should concentrate on the issue that how electric forces are exerted. In fact electric force should be existed in terms of field-field interaction. It means the applied electric field should interact with the electric field of the subjected charged particle in order to existence of the force. It may be called as existence of electric force through field-field interaction which is explained in brief in section VII.

At present, to have information of the motion, the simple way is to divided the particle into two hemispheres *A* and *B* as shown in Fig. 1 and calculate force on each one. Each hemisphere will have a centre of charge. Suppose *r'* is the distance between the centers of charges. Mass of each hemisphere is *m/2* and charge is *q/2*. The distance of center of charge act as two poles having same charge *q/2* and mass *m/2* separated by distance *r'*. The electric force *F*₁ on pole *A* and force *F*₂ on pole *B* respectively are

$$F_1 = \frac{qE_0}{2r} \tag{2}$$

$$F_2 = \frac{qE_0}{2(r+r')} \tag{3}$$

As the forces are unequal, the distances covered in a small time by these two poles are unequal. Consequently the net force is asymmetric. The distances *S*₁ and *S*₂ covered by the pole *A* and pole *B* in a small time *t*, respectively, are

$$S_1 = vt + \frac{qE_0}{2m} \frac{t^2}{r} \tag{4}$$

$$S_2 = vt + \frac{qE_0}{2m} \frac{t^2}{(r+r')} \tag{5}$$

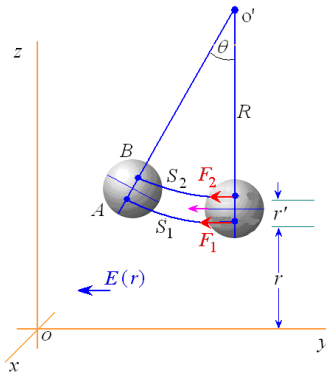


Fig. 1. Charged particle having initial velocity in the direction of the field is placed in static parallel electric field described by equation (1).

Due to the unequal distances ($S_1 \neq S_2$) the dipole or the particle itself follows a curved path. It turns away from y-axis or towards weak field. The radius of the curved path followed by the dipole at initial point is

$$R = \frac{r'S_2}{S_1 - S_2} = r \left(\frac{2mv}{qE_0t} (r + r') + 1 \right) \tag{6}$$

The particle gets pushed into weak field while acceleration. In other words, the particle gets pushed into weak field when the asymmetric electric force tries to accelerate.

If the two poles of the dipole coincides on each other and form a single charged particle having mass m and charge $+q$. This happens when $r' \rightarrow 0$. It is an ideal zero point charged particle. At this time equation (6) becomes

$$R = \frac{r'S_2}{S_1 - S_2} = r \left(\frac{2mvr}{qE_0t} + 1 \right) \tag{7}$$

Though the charged particle is zero point, it too follows a curved path which is very significant. The significance is that if an electron is subjected to the above field it too follows a curved path.

If initial velocity of the charged particle is in opposite direction of the field, the field tries to reduce the speed of the particle. It is illustrated in Fig. 2.

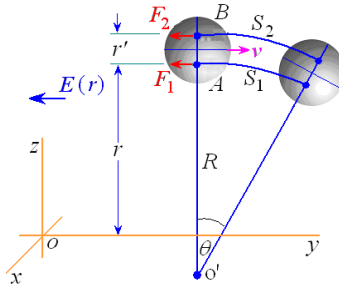


Fig. 1. Charged particle having initial velocity in opposite direction of the field is placed in static parallel electric field described by equation (1).

This time the radius of the curved path followed by the particle of zero pint size obeys the equation.

$$R = \frac{r'S_2}{S_1 - S_2} = r \left(\frac{2mvr}{qE_0t} - 1 \right) \tag{8}$$

In this case the asymmetric electric force pushes the particle into strong field while decelerating.

The above two motions are illustrated in Fig. 3 respectively by curve (a) and curve (b). Investigation of other two motions of the particle is also important. One motion is when the particle approaches y-axis in perpendicular direction of the polarization of the field. At this time the particle should get pushed along the direction of the force. This motion is illustrated by curve (c) in Fig. (3). The other motion is when the particle tries to go away

from y-axis in perpendicular direction of polarization of the field. At this time the particle should get turned in opposite direction of the force as represented by curve (d) in Fig. (3).

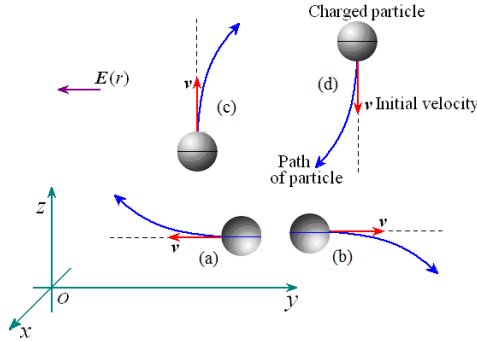


Fig. 3. Deflections of a charged particle with different initial velocities in parallel electric field described by equation (1).

III. COMPARISON BETWEEN ASYMMETRIC ELECTRIC FORCE AND MAGNETIC FORCE

Deflections of a charged particle with different initial velocities in the vicinity of a straight wire carrying steady electric current are illustrated in Fig. 4. These deflections are thought to be produced by the magnetic field of the current carrying wire.

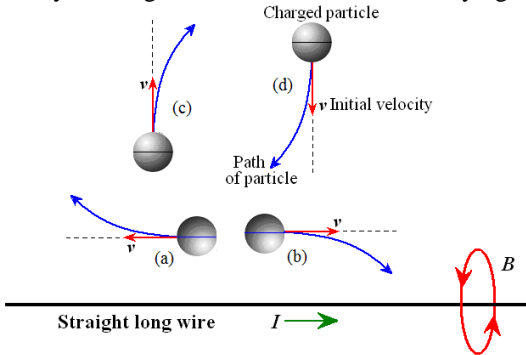


Fig. 4. Deflections of a charged particle with different initial velocities in vicinity of a long straight wire carrying steady electric current.

Deflections of a charged particle in Fig. 3 produced by the parallel electric field, described by equation (1), and deflections of a same charged particle in Fig. 4 produced by the magnetic field of the straight long wire carrying a steady electric current are same. We noticed same types of motions followed by the same charged particle in two different kinds of fields. This cannot be accepted. Since different fields are identified because of their different properties. Two different fields cannot have same properties. If they have then both fields must be of same kind. Therefore, the straight long wire carrying a steady electric current might be producing a parallel electric field like described by equation (1) and as illustrated in Fig. 4. In fact the true nature of the supposed magnetic field around a straight long wire carrying a steady electric current might be the parallel electric field. Equation for the parallel static electric field produced by a straight long wire with carrying steady electric current I should then be

$$E(r) = -k \frac{I}{r} \quad (9)$$

where k is proportionality constant and r is the perpendicular distance of the field point from the wire.

Production of the static parallel electric field by a straight long wire carrying steady electric current provides a possibility of construction of a current accelerator [16].

IV. DEFLECTION OF MAGNETIC NEEDLE IN STATIC PARALLEL ELECTRIC FIELD DESCRIBED BY EQUATION (1)

Magnetic field produced by any bar magnet is mostly due the spin alignment of the unpaired electrons in atoms constituting the magnet. Therefore, examination of asymmetric electric force on spinning electrons in the static parallel electric field described by equation (1) is necessary. Fig. 5 illustrates an electron having spin in clockwise direction subjected to the said parallel electric field. The field decreases in upward direction. Clearly, electric force F_B exerted on the upper hemisphere of the electron is less than force F_A exerted on lower hemisphere at any instant. Force F_A is decelerating force and force F_B is accelerating force and as $F_A > F_B$ then the net force is to produce deceleration consequently the electron should get pushed into the strong field or get pulled in downward direction as described in the figure.

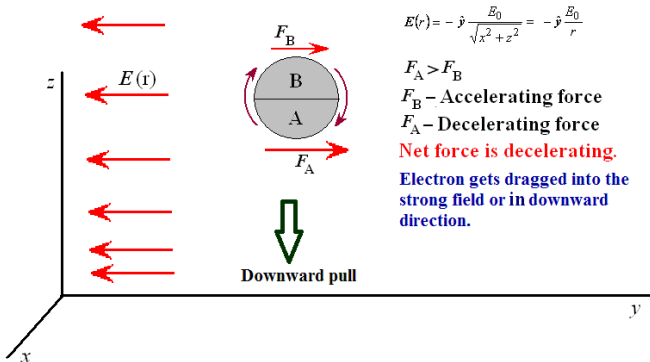


Fig.5. Electron, having clockwise spin, is suspended in static parallel electric field described by equation (1).

If the electron has anticlockwise spin, it should experience upward pull as the net asymmetric electric force attempts to accelerate the electron.

In bar magnets the positively and negatively charged particles are equal in number. If any bar magnet is suspended in the above parallel electric field then the net electric force is zero. Further, for paired electrons the net acceleration or deceleration force is zero. But for unpaired electrons the situation is different. In all bar magnets, spin of all unpaired electrons mostly aligned in one direction. If the suspended bar magnet is in such a position that the asymmetric electric force is in attempt to decelerate all the unpaired electrons, as like in Fig. 5, such all electrons and hence the bar magnet too will experience a downward pull and become stable. If the suspended bar magnet is in such a position that the asymmetric electric force is in attempt to accelerate the unpaired electrons, then such all electrons and hence the bar magnet too will experience an upward pull. Now the bar

magnet becomes unstable and will be triggered to rotate about its suspended axis and will get aligned finally where it experiences again a net downward pull as discussed above. Therefore, whatever may be the initial angle of the bar magnet with respect to the direction of the said parallel electric field (Fig. 6(a)), with examining the spin motion of the unpaired electrons relative to the poles, it should get finally aligned as illustrated in Fig. 6 (b).

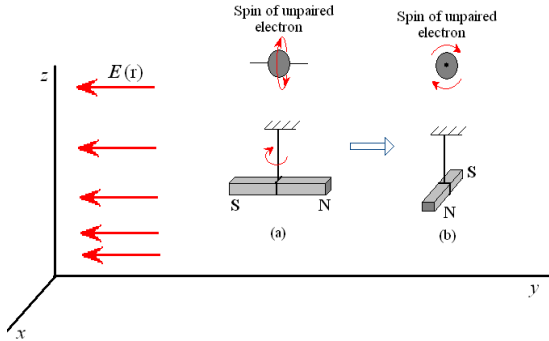


Fig. 6. Alignment of suspended bar magnet or a magnetic needle in the parallel static electric field described by equation (1).

The effective rotational force F_{eff} on the suspended bar magnet should be proportional to the strength of the field (E_0), the rate at which the field varies ($\frac{dE}{dr}$) and the number of unpaired electrons in the bar magnet or strength of the bar magnet.

A. Experimental deflection of magnetic needle in static electric field of dipole

To test the deflection of a magnetic needle an electric field which varies in the direction perpendicular to its polarization as described by equation (1) is required. Though exactly not like this but still a field varying in the direction perpendicular to its polarization on a plane, is produced by an electric dipole as shown in Fig. 7. The electric field equation on x-y plane is

$$\mathbf{E} = \frac{1}{4\pi\epsilon_0} \frac{\hat{z}2qa}{(a^2 + y^2)^{3/2}} \quad (10)$$

where \hat{z} is unit vector along z-axis.

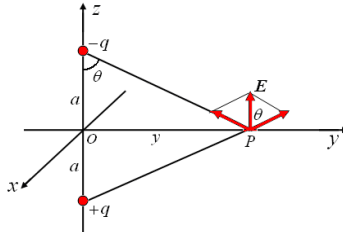


Fig. 7. Electric field of a dipole.

For experimental confirmation of the asymmetric electric force, such type of field can be produced experimentally by charging two parallel metallic plates separated by a small

distance as illustrated in Fig. 8. One may suspend a small magnetic bar, free to rotate, on the plates. Enclosing the system in a vacuum glass chamber may assure a proper electric field between the plates. The plates should be kept parallel to east-west direction. Before charging the plates, the magnet may be kept aligned in south-north direction. Now the charging of the plates should cause to rotation the magnetic needle and get aligned along the length of the plates as indicated in Fig. 8(b). By reversing the charge on the plates the magnetic bar should be rotated in opposite direction while getting aligned along the length of the plates. It will give experimental confirmation of asymmetric electric force.

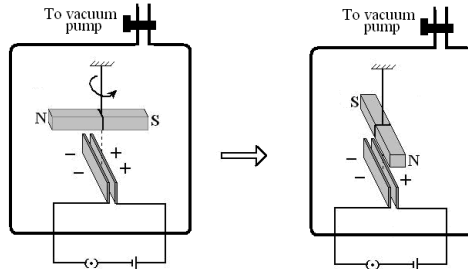


Fig. 8. Rotation of magnetic bar (magnetic needle) in electric field of dipole.

V. FIELD OF A BAR MAGNET

As a straight long wire carrying a steady electric current produces a parallel electric field given by equation (9) then a current carrying circular coil and hence a bar magnet must be producing circular electric fields around themselves. Though the field is circular, in which direction the magnitude of the field is varying should have significant impact on motion of the particle. Fig. 9(a) illustrates a circular field in anticlockwise in decreasing away from the center. When a charged particle approaches the center from left side then it should get deflected in downward direction. On the other hand, in Fig. 9(b), the circular field is again anticlockwise but now increasing in magnitude away from the center. In this case when a particle tries to approach the center from left side then it gets pushed in upward direction. Thus how the field varies is significant.

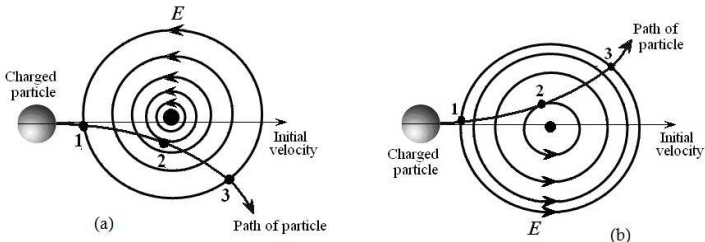


Fig. 9. Deflections of a charged particle in circular electric fields (a) magnitude decreasing away from center (b) magnitude increasing away from center.

The unpaired electrons in bar magnets constitute static circular electric current; therefore, they should also produce circular electric field. Consequently, the deflections of a charged particle obeyed in the field of a bar magnet should exactly be similar to the deflections observed in the circular electric fields described in Fig. 9. Surprisingly, this is

true. When a charged particle tries to move towards a bar magnet, as shown by path (a) in Fig. 10, the particle gets deflected in downward direction. This is happening because the net spin current constituted by the unpaired electrons, when we look from N pole to S pole of the bar magnet, is in clockwise direction. Therefore, the circular electric field produced by them around the bar magnet should be in anticlockwise direction and should decrease away from the bar as shown in Fig. 11. Hence, the charged particle obeys the deflection like discussed in Fig. 9(a). But when the particle is shifted at any one end of the bar magnet (path (b) in Fig. 10), the deflection gets inverted as like observed in Fig. 9(b) indicating that the electric field, in this region, increases away from the axis (Fig. 11). It increases until the surface of the cone where, normally, the magnetic field lines are supposed to turn in opposite direction. After the surface of the cone, the circular electric field again decreases in perpendicular direction to the length of the bar. If we place a free charged particle in one of the cone, the field applies torque on it. If the particle is on the axis of the magnet then it will acquire spin along the direction of torque and get pushed away from the magnet along the axis as the magnitude of the field decreases away. If the particle is placed inside the cone but not exactly on the axis then the field will push it towards the axis in addition to away from the bar magnet while rotating. Since, at axis the field has low value as compared to the value at surface of the cone. If a free charged particle is kept between two opposite poles of bar magnets, as described in Fig. 11, then it will be pushed while rotating to the point where the net field has low value. It will remain at that point on the axis with having spin in the direction of the torque. Another force is required to remove it from the axis. This is the actual reason why in Beaverton the D-types plates are required.

The circular electric field produced by bar magnets must play an important role in producing the attraction and repulsion between the poles.

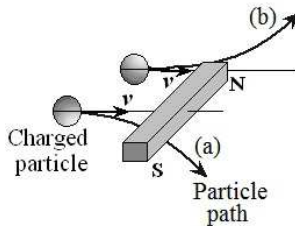
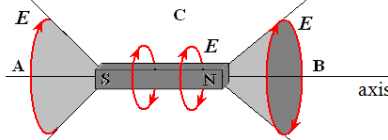


Fig. 10. Deflections of a positively charged particle in the field of a bar magnet.



In cone A and B, when we go in perpendicular direction to the axis, the electric field increases up to the surface of the cone. After it the field again decreases.

Fig. 11. Proposed electric field of a bar magnet.

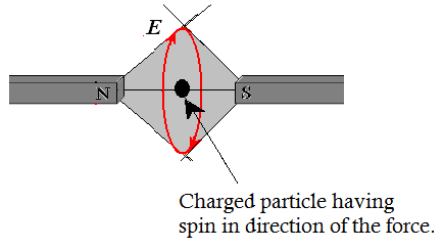


Fig. 12. Charged particle placed between two poles of bar magnets.

VI. ATTRACTION AND REPULSION BETWEEN POLES OF BAR MAGNETS

Fig. 13 illustrates the direction of the electric field and spin motion of the unpaired electrons of bar magnet M_1 . The unpaired electrons in bar magnet M_2 are spinning in the same direction as of the electric field of magnet M_1 . Therefore, the force imposed by the field of magnet M_1 should try to decelerate the spin velocity of the unpaired electrons of magnet M_2 . Because of this the unpaired electrons in magnet M_2 should get pulled towards the end of magnet M_1 as the electric field near the end is strong. In the same way the magnet M_2 should react with magnet M_1 . Therefore, both ends should get dragged towards each other. Further when like poles are close to each other, the electric field of one bar magnet is in attempt to accelerate the spin velocity of the unpaired electrons of the other magnet. Because of this the unpaired electrons of each bar magnet should get pushed away from the other bar magnet. In this way they are able to produce the illusion of repulsion. We notice that, though there is no any actual direct force of attraction or repulsion between the poles or ends of bar magnets, a torque, produced because of the circular asymmetric electric force, is responsible to produce the illusion. For paired electrons the net effect of asymmetric electric force is null.

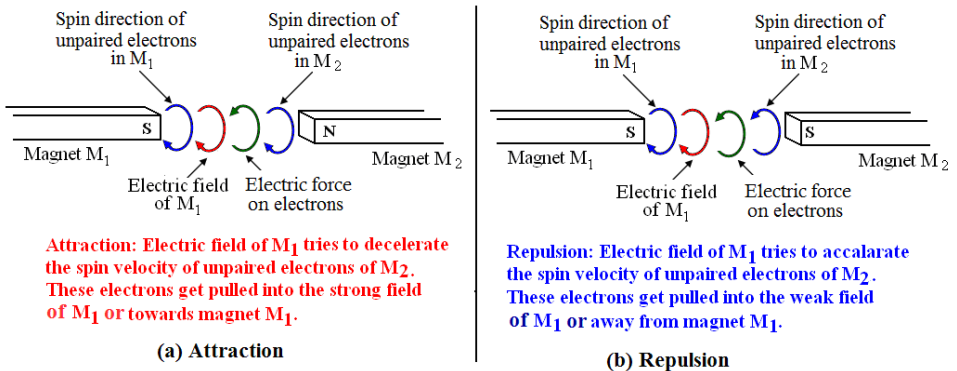


Fig. 13. Attraction and repulsion between poles of bar magnets in terms of circular asymmetric electric force.

VII. ELECTRIC FORCE THROUGH FIELD-FIELD INTERACTION

First necessary condition for existence of the electric force in terms of field-field interaction is the existence of electric field in space. The creation and propagation of EM

waves on oscillation of any charged particle confirms authentic existence of the electric field. Further, above discussion demonstrates that the effect of variation of magnitude of the electric field along perpendicular direction of its polarization is merely the magnetic effect. Therefore, an EM wave should consist of electric field only. Propagation of electric field in the form of a wave requires an elastic medium. Scientists have been already considered that medium as aether and many attempts have been made to detect it. Unfortunately it could not be detected yet. Propagation of electric field in terms of a wave strongly proposes existence of the aether medium. Propagation of electric field in terms of a wave in aether implies the electric field is purely one kind of pressure produced in the aether. Existence of two kinds of spherical symmetric electric fields (+ve and -ve) around fundamental charged particles (protons and electrons) implies the existence of spherical symmetric pressures about singular points in the elastic medium (or aether). Positive field around a proton may be called as inward pressure and negative field around an electron may be called as outward pressure. Inward pressure gets created about any point in an elastic medium just on removing some portion of the medium from that point. It can be a creation of one kind of electrical charged particle. Insertion of the removed portion at other point in the medium creates outward pressure. This is nothing but a creation of other kind of electrical charged particle. The method of creations of the pressure points or the charged particles tells why positively and negatively charged particles are equal in number. The medium will always try to be neutral as it is perfectly elastic. Therefore, the medium will try to bring these two opposite kinds of pressure points (or opposite kinds of electrical charged particles) close to each other in order have neutral space once again. This exhibits the attraction between opposite kinds of electrical charged particles. Two charged particles of same kind will be kept always away from each other since combination of them will increase magnitude of the pressure. This exhibits the repulsion between same kinds of electrical charged particles. It is obvious that these two kinds of pressure points may require forces of different magnitudes to move in the same fashion. The pressure point created by insertion of some portion of the medium may be easily moved from one place to other place by application of little external force. Obviously it should act as a particle of lower mass. The pressure point created by removing the portion of the medium may not be moved easily from one place to other place by application of the same external force. Obviously it should act as a particle of relatively higher mass as compared to the previous particle. The two opposite kinds of pressure points always try to recombine with each other in order to maintain the space neutral. The outward pressure point should have moved faster and may acquire spiral motion around the inward pressure point at the time of recombining. The disturbances created because of the spiral motion should be propagated in terms of a pressure waves or electric waves. It is nothing but creation of energy in the form of waves. All pairs of opposite kinds of pressure points may recombine with each other immediately after their creation. However, pairs of pressure points of particular magnitude may not be recombined easily and may help build the existing matter in the universe. Two pressure points having pressure in outward direction and are close may acquire opposite spin motion in order to reduce repulsion between them. Such kind of situation cannot be existed for inward pressure points, since; there is always an empty region at center of each inward pressure point. This type of nature of the medium or aether does not permit existence of any electrically neutral fundamental particle. Any exist-

tence of neutral particle must be a combination of two opposite kinds of electrical fundamental particles yet unable to recombine with each other. However a complete understanding of formation of such neutral particles would be a noble achievement. Next question is of gravitational force. If the space is actually filled by aether then there is no possibility of existence of any other kind of field except the electric field. If it is true then there can be two way to exist the gravitational force. First is because of imbalance between attractive and repulsive force between the charged particles or pressure points. The attractive force must be slightly stronger than the repulsive force. Second is the aether should always try to bring all disturbances (inward as well as outward pressure points and waves too) close to each other. Whatever may be it, the aether, filled in space, should allow existing of electric field waves only and not any other kind of waves. This is the reason why gravitational waves cannot be found in the universe.

The relative motion between two electrical charged particles depends upon nature of their electric fields. Furthermore, the relative motion between them is purely arising because of interaction between their fields. There is no presence of any kind of charge. Therefore, electrical force on any charged particle should be explained in terms of interaction between applied electric field and field of the charged particle. It may be termed as existence of electric force in terms of field-field interaction.

VIII. CONCLUSIONS

From the above discussion following conclusions may be drawn.

1. A static electric field whose magnitude varies in the direction perpendicular to its polarization produces asymmetric electric force consequently the charged particle moves along a curved path.
2. Static asymmetric electric force can produce deflection of a magnetic needle suspended in static electric field whose magnitude varies in the direction perpendicular to its polarization.
3. A straight long wire carrying a steady electric current might be producing a static electric field parallel to the wire pointing in opposite direction of the current. The strength of the field is decreasing away from the wire.
4. A circular electric force or an electric torque on unpaired electrons is responsible to produce the illusion of attraction or repulsion between the poles of bar magnets. There is no any direct force of attraction or repulsion between the poles of bar magnets.
5. The variation in magnitude of the electric field in perpendicular direction of its polarization is actually producing the magnetic effect. It implies there is no any reason to exist the magnetic monopoles in the universe.

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