DETERMINATION OF A NEW FORCE WITH CHARACTERISTICS OF NUCLEAR FORCE AND BOTH ATTRACTIVE AND REPULSIVE COMPONENTS

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Presently, a new force has been determined generated due to interaction between magnetic fields of the interacting particles, e.g., between electrons, between protons etc. in their respective beams, between nucleons in deuterons, alpha particles and nuclei etc. It has three very important characteristics: (i) it is strong; (ii) short range; and (iii) charge independent. These are exactly the same as we speculate for nuclear force between nucleons to have. Due to this force, electrons, protons etc. are all held together in their respective beams, and nucleons are held together in deuterons, alpha particles and nuclei etc. against the repulsive Coulomb force generated between them due to interaction between their charges. Due to interaction between magnetic fields of particles, a repulsive force, stronger than the repulsive Coulomb force, too is generated if the particles are moving parallel to each other but opposite in directions. Due to this repulsive force, the phenomena of alpha and beta decay take place from the nuclei. The potential, to which the presently determined force gives rise, happens to be of super soft core nature. It can succeed to explain the phenomena of scattering etc. equally well as the force succeeds to give very clear and complete understanding about the structures, properties etc. of deuterons, alpha particles and nuclei.

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1. INTRODUCTION

We observe that despite repulsive Coulomb force between similar charges, electrons, protons, alpha particles etc. are held together in their respective beams. It means, there is generated a force of attraction too between electrons, between protons etc. that keeps them bound together in their respective beams against the repulsive Coulomb force generated between them due to interaction between their charges. But how and because of which this force of attraction is generated, no explanation is found anywhere.

We further observe that as soon as the electrons start flowing through an electric current carrying rod or in an electron beam, there are simultaneously generated electromagnetism in them and magnetic fields around them in a plane perpendicular to the direction of flow of electrons through them. The generated magnetic field possess direction, i.e. anticlockwise (if the direction of flow of electrons through them is towards the face of clock). But currently no explanation is found anywhere as to how electromagnetism is generated in them, which type of magnetism is generated, how magnetic field is generated around them in a plane perpendicular to the direction of flow of electrons through them, and how that field possesses anticlockwise direction.

All the above observations lead to conclude that, since the generation of force of attraction between electrons in their beams, generation of electromagnetism in electron beams and in current carrying rods and generation of magnetic field around them etc. all take place simultaneously, it means, the cause behind the occurrence of all the above phenomena/ events is common/same. But what is that cause, is yet not known.

Currently, we know about the Yukawa's force[1] of attraction, stronger than the repulsive Coulomb force, acting between nucleons in nuclei. But for this force, it is assumed that there occurs a field of virtual π mesons between nucleons in nuclei and due to the continuous exchange of these virtual π mesons between nucleons, Yukawa's force of

attraction is generated between them (for detail, see Sec. 8). But can/does the field of virtual π mesons occur between electrons in electron beams, between protons in proton beams etc and due to the continuous exchange of virtual π mesons between electrons in electron beams, between protons in proton beams etc., the electrons and protons etc. are held together in their respective beams? Can, due to the continuous exchange of virtual π mesons between electrons in electron beams and in current carrying rods, electromagnetism be generated in them and magnetic field be generated around them?

Therefore, presently that cause (mentioned above) has been determined (see Sec. 2). Taking account of that cause, a new theory has been developed (see Sec. 3) which gives very clear and complete explanation as to how the force of attraction is generated between electrons (see Sec. 4.1), how electromagnetism is generated in electron beams (see Sec. 5) and current carrying rods (see Sec. 4.1, Ref. 2), which type of magnetism it happens to be (see Sec. 5 onwards and Sec. 4.2, Ref. 2), how magnetic fields is generated around them in a plane perpendicular to the direction of flow of electrons through them and how that field possess anticlockwise direction (see Sec. 5 onwards and Sec. 4.1, Ref. 2).

The generated force possesses both the components, attractive and repulsive depending upon the directions of motion of the interacting particles. If the interacting particles are moving parallel to each other and in the same direction, the force happens to be attractive (see Sec. 4.1). And if the interacting particles are moving parallel to each other but opposite in directions, the force happens to be repulsive (see Sec. 4.2).

The generated force happens to be strong, short range and charge independent (for detail, see Sec. 7). These characteristics are exactly similar to the characteristics of nuclear force. And consequently, the attractive component of the generated force between nucleons enables to give almost the complete knowledge about the structures, properties etc. of deuterons, alpha particles and nuclei (for detail, see Sec. 4, 5, 6, 7, 8 and 9, Ref. 3). And the

repulsive component of the generated force between nucleons enables to give the complete knowledge of how the emissions of alpha (α) and beta (β) particles take place from the nuclei during α and β decays (for detail, see Sec. 9.2, Ref. 3).

The potential, to which the presently determined force gives rise, possesses super soft core nature (see Sec. 9). Since the presently determined force succeeds to give very clear and complete understanding about the structures, properties etc. of deuterons, alpha particles and nuclei (see Sects. 4, 5, 6, 7, 8, Ref. 3), the potential too should succeed to explain the phenomena of scattering etc. equally well.

2. DETERMINED CAUSE

The current assumption that the electron possesses spin magnetic moment (μ_s) and magnetic field because of spin motion of its charge is not true (for detail, see Sec.1, Ref. 2).

The electron possesses a bundle of magnetism too by the virtue of nature similarly as it possesses a bundle of charge ($-e$) by the virtue of nature (for detail, see Sec. 2, Ref. 2). This magnetism occurs in the form of a circular ring, shown by a dark solid line circle around the charge of electron where charge has been shown by a spherical ball, Fig. 1(a), as for example, there occur rings around the planet Saturn. Around the charge of electron, there occurs its electric field [which has not been shown in Fig. 1(a)], and around magnetism of electron, there occurs its magnetic field shown by broken line circles, Fig. 1(a). The magnetism and charge of electron both spin, but in directions opposite to each other, shown by arrows in opposite directions, Fig. 1(b), where the ball of charge has been shown by quite a thick dark line circle and magnetism by comparatively a thinner dark line circle.

The spin magnetic moment (μ_s), which the electron possesses, arises due to the spin motion of this magnetism and occurs in the direction of its (magnetism) spin angular momentum.

The proton too possesses a bundle of magnetism by the virtue of nature similarly as it possesses a bundle of charge $+e$ by the virtue of nature. (For detail, see Sec. 3.2, Ref. 4.) About the structure of neutron, see Sec. 2, Ref. 5.

The magnetism and charge of electron and proton etc. spin in directions opposite to each other because then their respective fields interact (electromagnetic interaction) with each other such that their spin motions may persist. Their persistent spin motions provide persistent spin motions to electron and proton too (for detail, see Sec. 3, Ref. 4).

3. THE PRESENT THEORY

The spin motion of electrons (and similarly of protons and neutrons) generates two very important properties in them (see Sects. 3.1 and 3.2). Further, since the electrons possess magnetism; due to interaction between their magnetic fields, a force is also generated between them (for detail, see Sec. 4).

3.1 First property

The spin motion of every particle generates the tendency of linear motion in it along the direction of its spin angular momentum L_s (for verification of its truth, see Sec. I B, Ref. 6). Consequently, every spinning particle, e.g. electron, nucleon etc. possesses direction of its linear motion. By some means, e.g. applying some external electric or magnetic field on electron or proton etc, if the particle is made able to move, the direction of L_s of the particle is oriented and aligned in the direction according to Lorentz force and then it starts moving along the directions of its L_s (for confirmation that the direction of L_s, i.e., the direction of motion of electron is oriented and aligned, see Sec. 4.4, Ref. 2 and Sec. 5.4.1, Ref. 7).

3.2 Second property

If the frequency of spin motion of the particle is increased by some means, a stage comes when the particle starts moving itself along the direction of its L_S. Then after, as the

frequency of spin motion of the particle increases, the velocity of particle, e.g., electron, proton etc. goes on increasing in accordance to expression

$$v^2 = h\omega / m \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where m, v and ω respectively are the mass, linear velocity and frequency of spin motion of the particle and h is Planck's constant [for verification of the truth of expression (1), see Sec. I A, Ref. 6].

Due to spin motion, the particle obtains spin energy ($E_s = h\omega/2$, for detail, see Sec. II, Ref. 6). And due to its spin energy, it obtains spin momentum ($p_S = h\omega/v$, for detail, see Sec. II, Ref. 6) similarly as, due to its linear motion, it obtains kinetic energy (E_k) and linear momentum (p_{lin}). For verification of the truth of p_S of the particle, we can see Sec. I C, Ref. 6, and also can take the example of $h\nu/c$ of photons, which is currently being defined as momentum of photons, is in fact p_S of photons (for its confirmation and detail information, see Sec. 2.2, Ref. 8). It (p_S) is generated due to spin motion of photons that they (photons) derive from the orbiting electrons from which they are emitted (for confirmation of its truth, see Sec. I A, Ref. 6).

Therefore, the particles possessing linear motion together with their spin motion, they possess motional energy (E_m) $= E_k + E_s$, and motional momentum (p_m) $= p_{\text{lin}} + p_S$, and whenever comes the situation of conservation of energy and momentum of such particles (i.e. possessing spin motion along with their linear motion), E_m and p_m of particles actually conserve, not their E_k and p_{lin} (for verification of the truth of conservation of p_m , see Sec. I D, Ref. 6).

4. EXPLANATION OF HOW A FORCE IS GENERATED BETWEEN ELECTRONS DUE TO INTERACTION BETWEEN THEIR MAGNETIC FIELDS

The force generated between electrons due to interaction between their magnetic fields happens to be attractive or repulsive, depending upon the positions of the interacting electrons. As the positions of the interacting electrons take place, accordingly attractive or repulsive type of force is generated between them (see Sects. 4.1 and 4.2).

4.1 Explanation of how and when the force of attraction is generated

Let us consider two electrons A and B moving with velocity v parallel and adjacent to each other lying in the same vertical transverse plane, as shown in Fig. 2(a). Due to the first generated property (see Sec. 3.1) in electrons, the directions of their L_s lie parallel to each other. Then the planes of their magnetism and magnetic fields lie in the same plane and the directions of their spin motion lie in the same direction, Fig. 2(a). Let *r* be the radii of the outermost co-centric circular lines of force of the magnetic fields of electrons A and B. If the distance d between their centers becomes $< 2r$, their lines of force start interacting, as shown in Fig. 2(b). Let the distance *d* be such that the outermost two lines of force a_1 and a_2 of electron A interact with the outermost two lines of force b_1 and b_2 of electron B.

In this situation, in the region of their interaction (i.e. in between the electrons A and B) since the directions of lines of force a_1 and a_2 of electron A are opposite to the directions of lines of force b_1 and b_2 of electron B, Fig. 2(b), they repel each other. Consequently, the lines of force a_1, a_2 of electron A, after their repulsion, are diverted towards the electron B and dragged along with its (electron B) lines of force b_3, b_4 etc. and pushed behind the electron B, as shown in Fig. 2(b). And the lines of force b_1, b_2 of the electron B, after their repulsion, are diverted towards the electron A and dragged along with its (electron A) lines of force a_3, a_4 etc. and pushed behind the electron A. Finally the lines of force a_1, a_2 of electron A and b_1, b_2 of electrons B acquire the form, as shown in Fig. 2(b), and around point P, a neutral region is created (i.e. the region free from the effects of magnetic fields of electrons A

and B). In the process of getting pushed behind of the lines of force a_1, a_2 and b_1, b_2, they are expanded, and hence in order to obtain their original positions and form (i.e. shape) as they had before their interaction, they apply some pushing force on magnetic lines of force b_3, b_4 and a_3, a_4 respectively, which in turn apply pushing force on electrons B and A respectively. All these happen because, according to properties of magnetic lines of force, the magnetic lines of force are just like flexible strings and experience the longitudinal tension in its length, hence possess tendency to acquire their original form. In order to verify its truth, we can see Fig. 3, where the lines of force 3,4,5 and 6,7,8 of earth's magnetic field acquire their original positions and forms after coming out from the north pole of a bar magnet placed in magnetic meridian of earth's magnetic field. Consequently, a force of attraction ***F*** is generated between electrons A and B (for detail knowledge about force ***F***, see Sec. 6.1).

4.2 Explanation of how and when the force of repulsion is generated

If the two electrons A and B, are moving parallel to each other but opposite in directions, at some instant they may be adjacent to each other and lying in the same plane, Fig 4(a). In this situation, the directions of their L_s shall lie parallel to each other but opposite in directions and the planes of their magnetic fields shall lie in the same plane but the directions of spin motion of their magnetism and magnetic fields shall be opposite, as shown in Fig 4(a). If the distance *d* between their centers happens to be < 2r, their lines of force start interacting, Fig 4(b). Let the distance *d* between their centers be such that the two outermost lines of force a_1 and a_2 of electron A interact with the two outermost lines of force b_1 and b_2 of electron B, Fig 4(b).

In this situation, in the region of interaction between their magnetic fields (i.e. in region between the electrons A and B) their lines of force a_1, a_2 and b_1, b_2 are not repelled by each other but are dragged along with the lines of force of each other, as shown in Fig. 4(b). Because in this case, when their lines of force come close to each other, they are found

moving along the same direction, while for their repulsion it is essential that they must be in opposite directions [as occurs in previous case, Fig. 2(b)]. Hence, when their lines of force are dragged along with the lines of force of each other (i.e. a_1, a_2 of electron A are dragged along with b_1, b_2 of electron B) and pass through the space between a_3 and b_3 lines of force of magnetic fields of electrons A and B respectively, they come very close to each other [for convenience, they have been shown overlapping in Fig. 4(b), while actually they do not overlap], because the space left between the lines of force a_3 and b_3 for them to pass through happens to be very narrow, as appears from the Fig 4(b). But, due to their properties (mentioned earlier), they do not pass through this space coming very close to each other but pass through maintaining their original positions and shape as they had before their interaction. Therefore, in order to pass through, maintaining their original positions and shape, the lines of force a_1, a_2 apply some pushing force on lines of force a_3, a_4 etc., which in turn apply pushing force on electron A towards our left; and the lines of force b_1, b_2 apply some pushing force on lines of force b_3, b_4 etc., which in turn apply pushing force on electron B towards our right. Consequently, a force of repulsion $\boldsymbol{F}$ between electrons A and B is generated (for detail knowledge about force $\boldsymbol{F}$, see Sec. 6.2).

Thus two electrons A and B, moving parallel to each other but in opposite directions such that the distance d between their centers $<2r$, are acted upon by a repulsive force $\boldsymbol{F}$. But, since the two electrons A and B come close to each other, as shown in Fig. 4(b), just for a moment, they receive a sudden kick type of repulsive force from each other.

5. EXPLANATION OF HOW ELECTRONS ARE BOUND TOGETHER IN THEIR BEAMS AND HOW ELECTROMAGNETISM, MAGNETIC FIELD, WHICH POSSESSES DIRECTION, ARE GENERATED

According to first generated property (Sec. 3.1), since the electrons possess linear velocity along the directions of their spin angular momentum L_s (see Sec. 2), the directions of L_s of all the electrons of the beams are oriented and aligned in the direction of the external electric field applied to accelerate and collimate the electrons to form their beams (for its confirmation, see Sec. 4.4, Ref. 2). Then, the directions of their μ_s are oriented and aligned in direction opposite to the direction of the external magnetic field and the planes of their magnetism and magnetic field are oriented and aligned in planes perpendicular to the direction of motion of beam, or can say direction of motion of electrons of the beam. And the directions of spin motion of magnetism and magnetic field of electrons are oriented and aligned in direction anticlockwise (if the electrons of linear velocity of electrons in the beam are towards the face of clock).

Let us take, e.g., seven electrons of the beam moving with the same velocity v parallel and adjacent to each other lying in the same vertical transverse plane of the beam, as shown in Fig. 5. Their lines of force interact and consequently a force of attraction is generated between them, and their lines of force acquire the form as shown in Fig. 5. In similar manner, the lines of force of all the electrons, lying in every vertical transverse layer of the beam interact and consequently a force of attraction is generated between all the electrons of every vertical transverse layer of the beam and the lines of force of all the electrons of every vertical transverse layer acquire the form as shown in Fig. 6(a). And in this way finally a magnetic field is obtained in coaxial hollow cylindrical form around the beam all along its length, as shown in Fig. 6(b). [In Fig. 6(b), the lines of force, shown by vertical circles round the beam, each circle is in fact consisting of several co-centric circles, but for convenience not have been shown in Fig.] Further, since magnetism and magnetic field of electron possess anticlockwise direction (if the direction of motion of electron is towards the face of the clock), the magnetism generated in the beam and magnetic field generated around

and along the length of the beam also possess anticlockwise direction. The magnetism generated in the beam, happens to be diamagnetism (for its confirmation, see Sects. 4.2 and 4.3, Ref. 2).

In the beam, since the directions of μ_s of electrons are also oriented and aligned, the generated magnetism in the beam possesses spin magnetic moment in the direction of μ_s of electrons of the beam.

6. EXPLANATION OF HOW THE FORCE GENERATED DUE TO INTERACTION BETWEEN MAGNETIC FIELDS OF TWO ELECTRONS VARIES AS THE DISTANCE BETWEEN THEM VARIES

6.1 When the electrons are in position as shown in Fig. 2(b)

The force caused due to interaction between magnetic fields of electrons A and B when they are in position as shown in Fig. 2(b), varies as

$$F \propto d^{-q} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

where d is the distance between their centers, $q = a\,d^{b}$, and *a* and *b* are the constants which depend upon their velocities etc.

Why and how do the constants *a* and *b* depend upon the velocities of electrons A and B is as follows:

The velocity v and the frequency of spin motion ω of electron vary according to expression $m\mathrm{v}^2 = h\omega$ [see Eqn. (1), Sec. 3.2], and hence when v of electrons A and B vary, their ω also vary accordingly. When ω of electrons A and B increase, the strengths of their magnetic fields and hence the strength of pushing force by the lines of force of electron A on the electron B, and similarly the strength of pushing force by the lines of force of electron B on the electron A, Fig. 2(b), increase. This increase in force is accounted in expression (2) by variation in the constants *a* and *b*.

For verification of the truth of increase in the strength of magnetic fields of electrons A and B due to increase in their velocity (v), we can take the example of increase in the strength of magnetic field around the current carrying rod when the current through the rod is increased. The increase in current through the rod means the increase in velocity of electrons through the rod.

In expression (2), the force F is actually the resultant of two forces F_1 (attractive force caused due to interaction between the magnetisms of electrons A and B) and F_2 (repulsive force caused due to interaction between the charges of electrons A and B), i.e. $\boldsymbol{F = F_1 - F_2}$, because electrons possess both electric and magnetic fields, and hence F should be generated as the consequence of interaction between their both electric and magnetic fields. As d decreases, both F_1 and F_2 increase but such that F, after attaining a maximum value at $d = D$ (where $d = e^{-1/b}$ *and* $> d'$), it starts decreasing as d decreases because at $d = D$, $(dF/dd) = 0$ and $(d^2F/dd^2) = -\text{ve}$.

NOTE: When the two interacting particles in position, as shown in Fig. 2(b), are of different charges, e.g. A is electron and B is proton, then the interacting force *F* between them shall not be as $\boldsymbol{F = F_1 - F_2}$, but shall be as $\boldsymbol{F = F_1 + F_2}$**.** And hence the functional form of force F in expression (2) shall also be changed, which is to be determined.

6.1.1 Evidences to confirm the truth of the above equation 2

Though there is no mathematical proof to confirm the truth of equation (2) but there are numerous evidences from the well established existing knowledge to confirm its truth. For example, the electron, proton, α particle beams are obtained due to component F_1 of force F, but due to component F_2, the above beams do not persist for long time. (Behind non-persistence of electron, proton etc. beams, there are several more reasons, e.g. no

uniform velocity of all the electrons, protons etc. in their beams. But the component F_2 plays an important role.) For more evidences, see Sects. 4, 5, 6, Ref. 3

6.2 When the electrons are in position as shown in Fig. 4(b)

The force caused due to interaction between electrons A and B when they are in position as shown in Fig. 4(b), varies probably as

$$F \propto \exp(-a\,d^{b}) \quad \ldots\ldots\ldots\

Currently, according to Yukawa's meson field theory[1], a field of virtual π mesons is assumed between the nucleons in nuclei and due to their continuous exchange between the nucleons, the nuclear force is assumed to be generated. But it gives rise to numerous very fundamental questions. For example: 1. Virtual means which does not exist physically, then how can the field of such (i.e. virtual) π mesons occur? 2. How can such π mesons possess charge, that too positive or negative? 3. The real π mesons possess charge and mass both, while to virtual π mesons, only charge has been assigned and mass has not been assigned, why is this double standard or inconsistency? 4. As far as the author's knowledge is concerned, it is believed that there exist only matter and energy in the universe which are inter-convertible, in which category, matter or energy, do the virtual π mesons lie?

Further, does the field of virtual π mesons occur in proton and neutron beams and they (protons and neutrons) are held together against the repulsive Coulomb force in their respective beams due the continuous exchange of virtual π mesons between them? If not, then:

1. Why is this inconsistency? When the field of virtual π mesons can occur in nuclei, it should occur in proton and neutron beams too because these are also nucleons.

2. How electrons, protons etc. are held together in their respective beams against the repulsive Coulomb force?

And if yes, then:

1. The field of virtual π mesons should occur in electron beams too, and due to the exchange of π mesons between electrons, the electrons should be held together in electron beams. Can it happen so? If not, then how are the electrons held together in their beams?

2. The neutron beams should exist in nature similarly as nuclei exist in nature, and even with more strong stability. Because, in neutron beams, there occur no protons and hence no

repulsive Coulomb force comes into play. But on the contrary, the neutron beams do not survive even as long as the proton beams survive. Here some people may argue, it happens because neutrons start decaying after their mean life time and consequently neutron beams are destroyed. This argument is true but it gives rise to questions: Then why and how do neutrons not decay in deuterons (D), alpha particles (α) and nuclei? What does happen with the presence of protons in D, α and nuclei such that the neutrons in them stop decaying and become stable? If one more proton is added in D, the resultant system (i.e. He^3) becomes more stable, but if one more neutron is added in D, though the binding energy per nucleon (E_b) of the resultant system (i.e. H^3) is increased in comparison to that of the system He^3 but the system (i.e. H^3) becomes unstable and decays into He^3 through β decay. Despite $(E_b)_{H^3} > (E_b)_{He^3}$ [where $(E_b)_{H^3}$ is the binding energy per nucleon in the nucleus of H^3 and $(E_b)_{He^3}$ is the binding energy per nucleon in the nucleus of He^3], why and how does H^3 decays into He^3? Further, if one neutron is added in He^3 or one proton in H^3, the resultant system (i.e. α particle) becomes so strongly stable that it starts behaving like a particle. While if one proton is added in He^3 or one neutron in H^3, the resultant systems, i.e. isotope Li^4 (half life time $=9.1\times10^{-23}$ s) and isotope H^4 (half life time = 1.39×10^{-22} s) respectively become extremely unstable. The isotope Li^4 is though found in nature but the isotope H^4 is not found in nature. It is obtained by synthesis. (For detail, see Sects. 4, 5, and 6, Ref. 3.)

The presently determined force generated between nucleons gives very clear and complete explanation of each and every phenomenon/event mentioned above, and also of why and how the systems, di-proton and di-neutron do not exist in nature despite the existence of these is theoretically possible (see Sects. 4, 5, 6, Ref. 3).

The attractive component of the presently determined force generated between nucleons gives almost a complete knowledge about the structures, properties etc. of

deuterons, alpha particles and nuclei (for detail, see Sec. 4, 5, 6, 7, 8 and 9, Ref. 3). And the repulsive component gives the complete knowledge of how the emissions of alpha (α) and beta (β) particles take place from the nuclei (for detail, see Sec. 9.2, Ref. 3).

9. DEDUCTION OF AN EXPRESSION FOR POTENTIAL BETWEEN NUCLEONS, ITS PECULIAR NATURE AND IMPORTANCE

As we see from expression (2), in it, since the term d^{-q}, where $q = a\,d^{b}$ (see Sec. 6.1), is very complicated; it is very-very difficult to deduce an expression for potential between nucleons analytically. But it can be estimated approximately, or can say, roughly as follows:

$$V \propto d\,d^{-q} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

If we plot a graph between V and d, we find the potential to be of super soft core nature, different from the natures of Yukawa and Gaussian potentials, which are respectively of hard and soft core nature.

Since the force, i.e. expression (2) succeeds to give very clear and complete understanding about the structures, properties etc. of deuterons, alpha particles and nuclei (see Sects. 4, 5, 6, 7, 8, Ref. 3), the potential, i.e. expression (4) should succeed to explain the phenomena of scattering etc. too equally well.

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FIGURE CAPTIONS

Fig. 1: (a) Spherical ball, dark solid line circle and concentric broken line circles respectively represent the charge, magnetism and magnetic field of electron. (b) Cross sectional view of electron where, in order to introduce arrow marks with the ball of charge to show the direction of its spin motion, the ball of charge has been shown by a dark thick solid line circle.

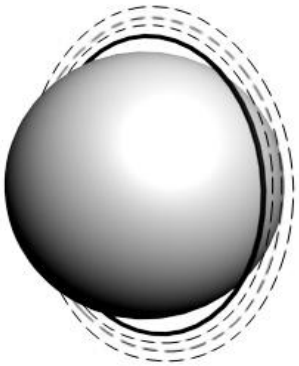
Fig. 2: (a) Transverse cross sectional view of two electrons A and B moving with same velocity v parallel and adjacent to each other at distance *d* apart lying in the same vertical plane; (b) Transverse cross sectional view of interaction between their magnetic fields when the distance *d* between them is reduced to < 2r.

Fig. 3: Longitudinal cross sectional view of interaction between the earth's magnetic field and the magnetic field around a bar magnet, placed in magnetic meridian.

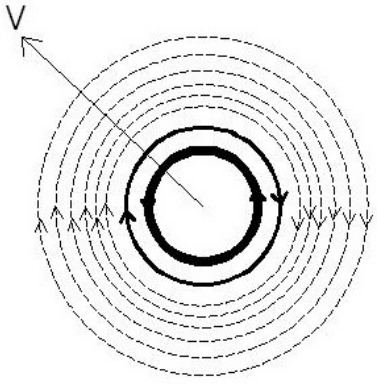
Fig. 4: (a) Transverse cross sectional view of two electrons A and B at the instant when they are in the same plane and at distance *d* apart while moving parallel to each other with same velocity v but opposite in directions. (b) Transverse cross sectional view of interaction between their magnetic fields when the distance d between them is reduced to < 2r.

Fig. 5: Transverse cross sectional view of interaction between the magnetic fields of 7 electrons lying in the same vertical plane while moving parallel to each other in the same direction with the same velocity v.

Fig. 6: (a) Transverse cross sectional view of magnetic field created around the electron beam. (b) Longitudinal view of magnetic field created around the electron beam.

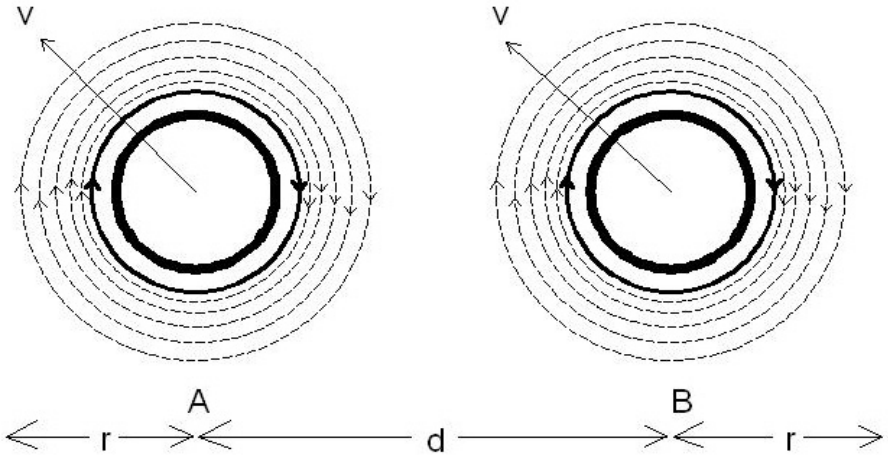


(a)

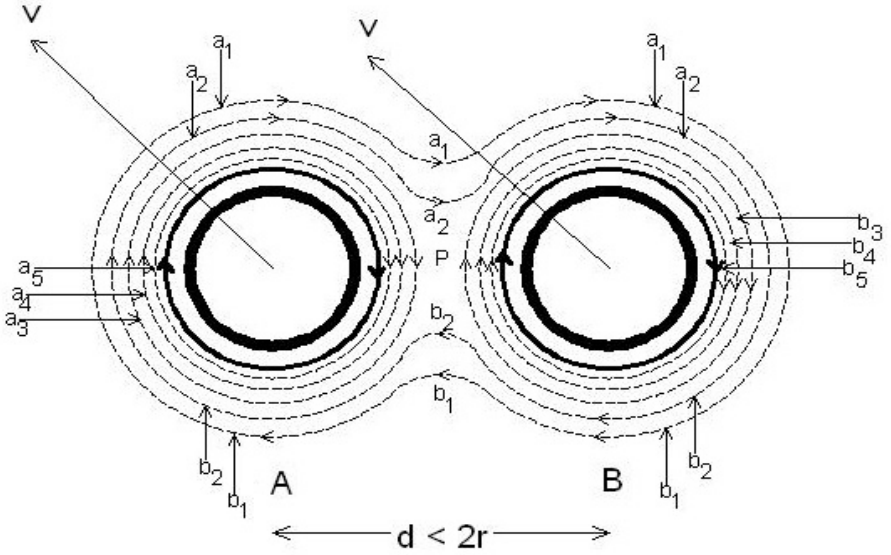


(b)

Fig. 1



(a)



(b)

Fig. 2

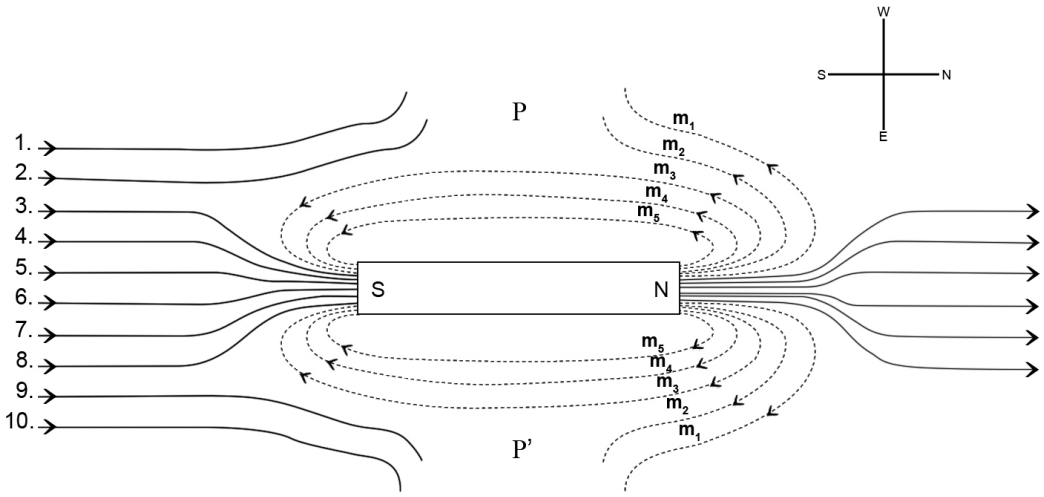
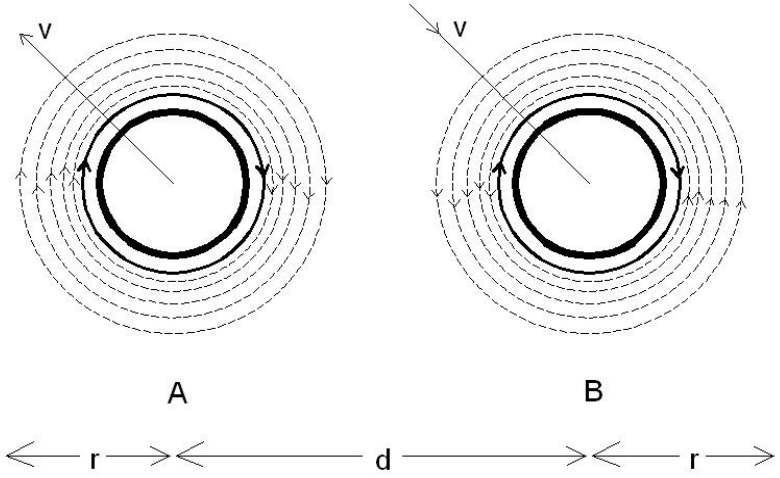
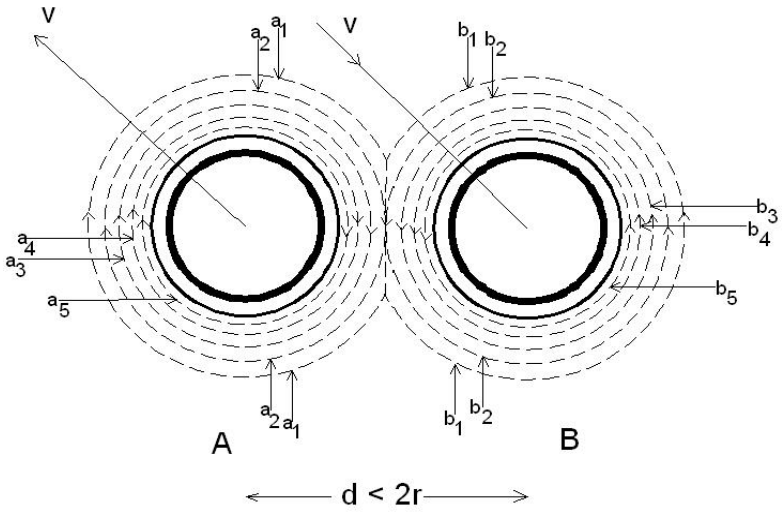


Fig. 3



(a)



(b)

Fig. 4

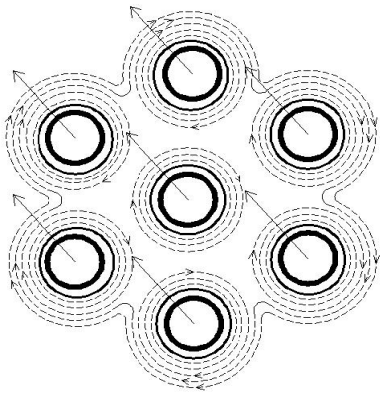
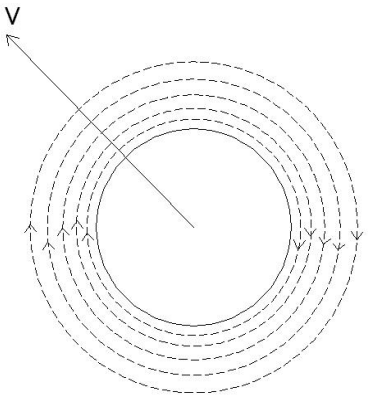


Fig. 5



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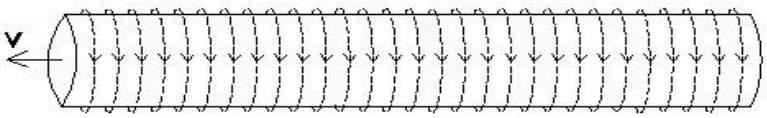

(b)

Fig. 6