A new force with characteristics of nuclear force and both attractive and repulsive components

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Because all electrons, nucleons, and other particles undergo a persistent spin motion without having any source of infinite energy, they should have a unique structure that keeps them persistently spinning and provides all the properties that they display. In addition, there should be some reason or purpose why they show a persistent spin motion, because, in nature, nothing occurs without a reason or purpose. Therefore, the unique structures of electrons, and nucleons, and purpose why they possess persistent spin motion have been determined. The results of these determinations provide the knowledge of a new force possessing characteristics of nuclear force and both attractive and repulsive components, and very clear and complete explanation of: 1) all the phenomena; 2) all the properties and effects of their systems; and 3) structures of their systems, e.g., deuterons, alpha particles, and nuclei; those are generated due to these particles. In the present study, the mentioned above new force has been determined. The attractive component of this force provides very clear and complete explanations of how: 1) electrons, protons, and so forth are bound together in their respective beams despite similar charges on them; 2) the energy of free electrons of the substances is reduced when the substances acquire superconducting state; 3) neutrons become stable and nucleons are bound together in deuterons, alpha particles, and nuclei. The repulsive component provides explanation of how alpha and beta particles are emitted from nuclei when the nuclei become radioactive. Further, the above force gives rise to a potential of unique, super soft core nature.

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1 Introduction

As we know, in nature, nothing occurs without a reason or purpose. For example, our hearts persistently beat without having a source of infinite energy, which does not happen without a reason because an important reason exists as to why our hearts beat, in addition to why they have a unique structure that keeps them persistently beating and hence provides all the properties that they display. Therefore, because all electrons, nucleons, and other particles possess a persistent spin motion without having any source of infinite energy, some reason or purpose should exist why they show a persistent spin motion. In addition, such particles should have a unique structure that keeps them persistently spinning and provides all the properties that they display.

Further, as we know, all phenomena or activities related to our hearts, e.g., continuous blood circulation in our bodies, are the consequences of the purpose behind the persistent beating of our hearts, their special structure, and their properties. Similarly, all phenomena or activities related to electrons, nucleons, and other particles should have been the consequences of the purpose behind their persistent spin motion, their unique structure, and their properties.

Therefore, the unique structure of electrons, Fig. 1, and nucleons (see Section 3, [1]), and purpose why they display a persistent spin motion (see Section 2, [1]) have been determined. The results of these determinations [see bullets 1), and 2), and bullets i), ii), and iii), Section 2] provide the knowledge of a new force which possesses the characteristics of nuclear force and both attractive and repulsive components (Section 4.2, [1]), and very clear and complete explanations of: 1) all the phenomena (Section 4.1, [1]); 2) all the properties and effects of their systems, e.g., their beams, substances at their both normal and superconducting states, deuterons, alpha particles, and nuclei (Section 4.2, [1]); and iii) structures of their systems, e.g., deuterons, alpha particles, and nuclei (Section 4.2, [1]) ; those are generated due to these particles.

The present study is focussed on to provide understanding of:

1) how the attractive component of the new force is generated (see Section 3.1), and how its magnitude varies as the distance between interacting particles varies (see Section 4.1);

2) how the repulsive component of the new force is generated (see Section 3.2), and how its magnitude varies as the distance between interacting particles varies (see Section 4.2).

The attractive component of the new force provides very clear and complete explanation of how:

1) electrons, protons, and so forth are bound together in their respective beams, especially electrons and protons despite similar charges on them (see Section 3, [2]);

2) the energy of free electrons of the substances is reduced when the substances acquire the superconducting state (see Section 4.7.1, [3]);

3) neutrons become stable and the nucleons are bound together in deuterons, alpha particles, and nuclei (see Sections 3.1, 3.2, 3.3, 3.4, and 3.5, [4]).

The repulsive component of the new force provides very clear and complete explanation of how alpha (α) and beta (β) particles are emitted from the nuclei when their mass number (A) becomes > 200 and the nuclei become radioactive {see bullet a) of Section 3.6.2, [4]}.

Further, the new force gives rise to a potential of unique, super soft core nature (see Section 7). It is unlike the Yukawa potential [5] which is of hard core nature, and the Gaussian potential which is of soft core nature.

Currently, the known force, which possesses the characteristics of nuclear force, is only the Yukawa force [5], but it possesses only the attractive component, and no repulsive component. Second, it is assumed generated between nucleons in nuclei as the consequence of continuous exchange between nucleons of virtual π mesons, a field of which is assumed between nucleons in nuclei, where, the concept of a field of virtual π mesons between nucleons gives rise to numerous very fundamental questions. For example:

1) Virtual means which physically does not exist, then how can the exchange of such π mesons occur between nucleons?

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 the charge has been assigned, and the mass has not been assigned. Why is this inconsistency?

4) As it is believed that, in universe, only matter and energy occur, in which category- matter or energy, do the virtual π mesons lie?

Further, does the field of virtual π mesons occur between protons, between neutrons in their respective beams, and they are bound together in their respective beams due to continuous exchange of virtual π mesons between them, especially protons in their beams against the Coulomb repulsive force, which is generated between protons due to similar charges on them?

If not, then why is this inconsistency? When the field of virtual π mesons can occur between nucleons in nuclei and the nucleons are bound together in them, it should/can occur between protons in proton beams and between neutrons in neutron beams too, and they should be bound together in their respective beams.

If yes, then: 1) the neutron beams should exist in nature, similarly, as nuclei exist in nature, even with more strong stability. Because, in neutron beams, there occur no protons and hence no repulsive Coulomb force comes into play. While on the contrary, the neutron beams do not survive even as long as the proton beams survive. It is believed that this happens because neutrons start decaying after their mean life time and consequently the neutron beams are destroyed. Then why do neutrons not decay in deuterons, alpha particles and nuclei? If some situation is created in deuterons, alpha particles, and nuclei, due to which the neutrons become stable in them, what is that situation? Why is that situation not being created in neutron beams? 2) The field of virtual π mesons should occur between electrons in electron beams too, and the electrons should be held together in their beams due to continuous exchange of π

mesons between electrons. Can/does it happen so? If not, then how are the electrons held together in their beams against the repulsive Coulomb force?

2 Results of the determination of the purpose why electrons and nucleons possess persistent spin motion, and of the determination of their unique structure

Because the purpose (see Section 2, [1]) why all electrons, nucleons, and other particles possess the property of persistent spin motion is to generate in them:

1) linear velocities (v) along the directions of their respective L_S, where (v) varies with their frequency of spin motion (ω) (see Section 2.1, [1] for detail information);

2) motional energy E_M [= kinetic energy (E_K) + spin energy (E_S)] and motional momentum p_M [= linear momentum (p_{LIN}) + spin momentum (p_S)] (see Section 2.2, [1] for detail information);

all electrons, nucleons, and other particles are always found in a state of linear motion oriented along their respective L_S directions. The energy (E_M), momentum (p_M), and spin angular momentum (L_S) of electrons, nucleons, and other particles are always conserved during their motion, even when the rate of velocity increase in electrons accelerated by a large voltage (see Bertozzi's experiment [6] for example) starts decreasing after they attain their relativistic velocity, or when electrons move along their elliptical orbits (see Section 2.2, [1] for details.

Moreover, because of the unique structure of electrons, and nucleons (see Section 3, [1]):

i) the planes of their magnetic rings and magnetic ring's magnetic fields lie always in a plane perpendicular to the directions of their respective v;

ii) the directions of their spin magnetic moments (μ_S) lie always opposite to the directions their respective v;

iii) the directions of spin motion of their rings of magnetism and of the magnetic ring's magnetic fields occur always in clockwise direction, if the direction of their v is opposite to the face of clock.

3 Explanation of how the new force is generated between two electrons

3.1 Explanation of how the force of attraction is generated between two electrons

Let us suppose, two electrons A and B, having their unique structure as shown in Fig. 1, moving parallel and very close to each other with velocity v in the same direction (perpendicular to the plane of the paper and towards our face). If they lie in the same plane, then, because of the results of their unique structure {see bullets i), ii), and iii) of Section 2}, the planes of their magnetic rings and of magnetic ring's magnetic fields lie in the same plane (plane of the paper), and directions of spin motion of their magnetic rings and of magnetic ring's magnetic fields occur in directions as shown by arrows in Fig. 2(a).

Let r be the radii of the outermost co-centric circular lines of force of the magnetic fields of both electrons A and B. If the distance d between their centers happens to be $< 2r$, Fig. 2(b), 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 electrons A and B), because 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), the lines of force a_1, a_2 are repelled by the lines of force b_1, b_2. Consequently, the lines of force a_1, a_2 of electron A, after their repulsion, are diverted towards the electron B and are dragged along with the lines of force b_3, b_4 etc. of the electron B, and similarly, the lines of force b_1, b_2 of the electron B, after their repulsion, are diverted towards the electron A and are dragged along with the lines of force a_3, a_4 etc. of the electron A, as shown in Fig. 2(b). According to properties of magnetic lines of force, because they are like stretchable or flexible strings and experience the longitudinal tension in their length, they possess the tendency to acquire their original form, Therefore, when the lines of force a_1, a_2 reach behind the electron B, and the lines of force b_1, b_2 reach behind the electron A, they are happened to be stretched, and hence, in order to acquire their original form as they had before their interaction, the lines of force a_1, a_2 pull the lines of force b_3, b_4, and so forth, which in turn pull the electron B towards the electron A, and similarly, the lines of force b_1, b_2 pull the lines of force a_3, a_4, and so forth, which in turn pull the electron A towards the electron B. Further, because of repulsions of the lines of force a_1, a_2 and b_1, b_2, a neutral space (free from lines of force) P is left between electrons A and B, as shown in Fig. 2(b), and therefore, when the electron A is pulled towards the electron B, and the electron B is pulled towards the electron A, they come close to each other. Thus, a force of attraction F is generated between electrons A and B.

3.2 Explanation of how the force of repulsion is generated between two electrons

Suppose, if the electrons A and B are moving in opposite directions, the situation is created as shown in Fig. 3(a). In this situation, if the distance d between their centers happens to be $< 2r$, Fig. 3(b), their lines of force start interacting again, but the result of their interaction happens to be changed. Because, in this situation, in the region of interaction of the lines of force of electron A with the lines of force of electron B, the directions of the lines of force of electron A are not opposite to the directions of the lines of force electron B, but are in the same directions, Fig. 3(b), the lines of force a_1, a_2 do not repel the lines of force b_1, b_2. Due to reduction in d, because the space between the lines of force a_3 and b_3 is reduced, the lines of force a_1, a_2 and the lines of force b_1, b_2, while passing through the space between the lines of force a_3 and b_3, become very close to each other. [In Fig. 3(b), to show with clarity the passage of the lines of force a_1, a_2 and b_1, b_2 very close each other is very difficult, therefore, their passage has not been shown.] When the lines of force a_1, a_2 and the lines of force b_1, b_2 become very close to each other, in order to acquire their original shapes or form as they had before their interaction, the lines of force a_1, a_2 apply some pulling force on the lines of force a_3, a_4, and so forth, which in turn apply pulling force on electron A towards our left; and the lines of force b_1, b_2 apply some pulling force on lines of force b_3, b_4, and so forth, which in turn apply pulling force on electron B towards our right. Thus, a force of repulsion $\boldsymbol{F}$ is generated between electrons A and B. However, because electrons A and B are moving in opposite directions, they come in position as shown in Fig. 3(b) just for moment, the electrons A and B experience the repulsive force as a sudden kick from each other.

4 Explanation of how the force generated between two electrons varies as the distance between them varies

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

As the distance d between centers of the electrons A and B decreases, Fig. 2(b), the number of magnetic lines of force of the electron A interacting with the number of magnetic lines of force of the electron B both go on increasing, till d becomes $= d'$, at which (i.e. $d = d'$) all or maximum number of magnetic lines of force of the electron A interact with all or maximum number of magnetic lines of force of the electron B. After that, as d decreases, the number of magnetic lines of force of the electron A available to interact with available number of magnetic lines of force of the electron B both start decreasing, which (decreasing) goes on continuously. Accordingly, the force of attraction F between electrons A and B goes on increasing as d decreases, till d becomes $= d'$, at which the fore F becomes maximum, and after that, as d decreases, the force F starts decreasing. However, after d becomes $= d'$, the distance between balls of charge of the electrons A and B is probably reduced as much that the repulsive Coulomb force generated due to interaction between electric fields of the electrons A and B also starts becoming effective. Consequently, after d becomes $= d'$, as d decreases, the decrease in force F happens to be rapid.

The force F depends also upon the rate of interaction between magnetic lines of force of the electrons A and B. Because, we observe that, as an electric current flowing through two parallel electric current carrying wires increases, the force of attraction between wires increases. The increase in electric current flowing through the wires means the increase in velocity (v) of electrons flowing through the wires, and the increase in velocity of electrons means the increase in frequency of spin motion (ω) of the electrons, because v and ω of electrons are related with each other according to expression [7]

$$\mathrm{m}\,\mathrm{v}^2 = h\,\omega \qquad (1)$$

(where m is mass of the electron, and h is the Planck's constant). Due to increase in ω of the electrons, the frequency of spin motion of the magnetic fields generated around the current carrying wires increases which increases the strength of magnetic fields generated around the wires (see Section 4.1, [2] for detail information). Due to this increase, the rate of interaction between magnetic fields generated around the current carrying wires increases, and due to increase in the rate of interaction, the force of attraction generated between current carrying wires increases.

The expression for F , presently formulated as follows:

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

(where d is the distance between centers of the interacting electrons A and B , and $q = a\,d^{b}$, where a and b are the constants) has although been developed empirically, but it takes into account all the three factors mentioned above. Because, if we examine the nature of d^{-q} , we find that, as d decreases, at $d = e^{-1/b}$, $dF/dd = 0$, and $d^2F/dd^2 = -\mathrm{ve}$, which means, at $d = e^{-1/b}$ $(= d')$, the force F becomes maximum, and after that it decreases rapidly. The constants a and b account the effects on d of all the three factors mentioned above.

The force F , in simple form can be defined as $F = F_1$ (attractive force generated due to interaction between magnetic fields of the magnetic rings of the electrons A and B) - F_2 (repulsive force generated due to interaction between electric fields of the balls of charge of the electrons A and B), i.e., $F = F_1 - F_2$.

However, if the interacting particles are of opposite charges, e.g., A is electron and B is proton, the component F_2 of F, which (F_2) is generated due to interaction between electric fields of the interacting particles (electron A and proton B) and starts becoming effective after $d = d'$, becomes attractive, and hence the form of F becomes as $F = F_1 + F_2$. Therefore, in this case, after $d = d'$, as d decreases, F does not decrease. Instead, it (F) continues increasing, and ultimately, the electron and proton merge into a single particle. (Their merger is an important incident, rather an event, because it provides a plausible solution to a very challenging and important problem of space scientific. Its detail study shall be provided later on.)

4.1.1 Evidences to confirm the truth of the above equation (2)

There is no mathematical proof to confirm the truth of Eqn. (2). However, there are numerous evidences from the well established existing knowledge to confirm its truth. For example, the electron, and proton beams are obtained due to component F_1 of force F, but the component F_2 does not let their beams to be persistent or permanent.

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

As in the previous case (Section 4.1), similarly in this case also, as the distance d between centers of the electrons A and B decreases, Fig. 3(b), due to interaction between magnetic lines of force of electrons A and B, a force F is generated between them, but that (F) happens to be repulsive (see Section 3.2). It goes on increasing till d becomes $= d'$, at which ($d = d'$) F becomes maximum. After $d = d'$, as d decreases, the force F starts decreasing, as in the previous case, but after $d = d'$, because a repulsive force generated due to interaction between electric fields of the electrons A and B starts becoming effective, the force F $(= -F_1 - F_2)$, instead of decreasing, continues increasing.

The expression for F, presently formulated as follows:

$$F \propto -\exp(-a\,d^{\,b}) \qquad (3)$$

(where d is the distance between centers of the interacting electrons A and B, and a and b are the constants) has although been developed empirically, but it takes into account all the three factors mentioned in Section 4.1. Because, if we examine the nature of $\exp(-a\,d^{\,b})$, we find that, it goes on increasing continuously.

However, if the interacting particles are of opposite charges, e.g., A is electron and B is proton, then as d decreases, F goes on increasing till d becomes $= d'$, at which ($d = d'$) F becomes maximum. After $d = d'$, as d decreases, the force F starts decreasing, but after $d = d'$, because an attractive force generated due to interaction between electric fields of electron A and proton B starts becoming effective, the force F (= $-F_1 + F_2$) starts decreasing.

4.2.1 Evidence to confirm the truth of the above force (i.e. of eqn. 3)

To confirm the truth of the above expression (3) too, there is no mathematical proof.

5 Characteristics of the new force

As we observe from Figs. 2(b) and 3(b):

1. Because this force is generated when the interacting particles are very close to each other such that their magnetic lines of force may interact, this force should be of short range force.

2. Because this force is originated due to interaction between magnetic fields of the interacting particles, this force should be charge independent.

3. Because this force happens to be stronger than the repulsive Coulomb force, this force should be strong.

The above characteristics of the new force are exactly the same as we guess for nuclear force to have.

6. Importance of the new force

The attractive component of the present force enables us to provide very clear and complete explanations of all the properties and effects generated due to electrons, and nucleons in their systems, e.g., their beams (see Section 3, [2]), substances at normal state (see Sections 4, 6, and 7, [2]), substances at superconducting state (see Section 4, [3]), deuterons, alpha particles, and nuclei (see Sections 3.1 to 3.6, [4]), and structures of deuterons, alpha particles, and nuclei (see Sections 3.1 to 3.5, [4]). The explained properties include those properties too, which could have never been explained before.

The repulsive component of the present force enables us to provide very clear and complete explanations of how alpha (α) and beta (β) particles are emitted from the nuclei when their mass number (A) becomes > 200 and the nuclei become radioactive {see bullet a) of Section 3.6.2, [4]}.

7. Deduction of an expression for potential between two particles and its unique nature

As we see from Eqn. (2), in it, because the term d^{-q}, where $q = a\,d^{b}$ (see Section 4.1), is very complicated, it is very difficult to deduce an expression for potential analytically. Therefore, the expression for potential has also been determined on empirical basis as follows;

$$V \propto d\, d^{-q} \tag{4}$$

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

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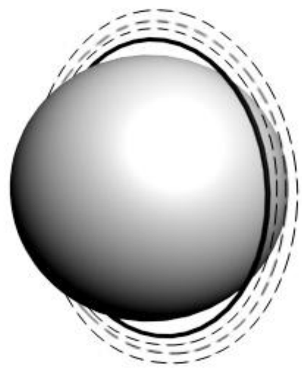
FIGURE CAPTIONS

Fig. 1 The spherical ball, dark solid-line circle, and concentric broken-line circles represent respectively the charge, magnetism, and magnetic field of an electron. (b) Transverse cross-sectional view of an electron where the ball of charge is indicated by a dark, thick, and solid-line circle, magnetism by a dark, thin, and solid-line circle, and magnetic field by broken-line circles with arrows to show the directions of their spin motion.

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

Fig. 3 (a) Transverse cross sectional view of two electrons A and B at the instant when they are in the same vertical 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 $< 2r$.



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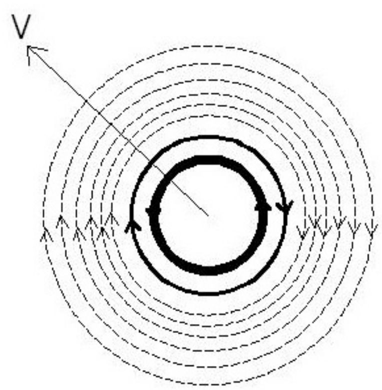
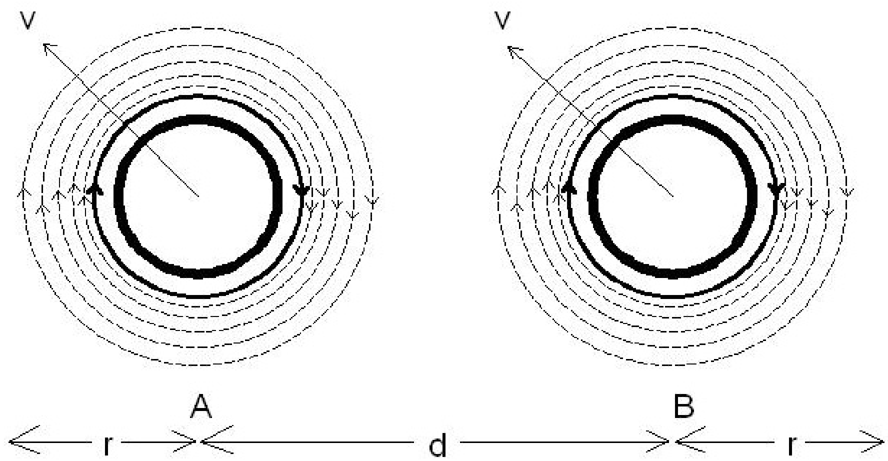


(b)

Fig. 1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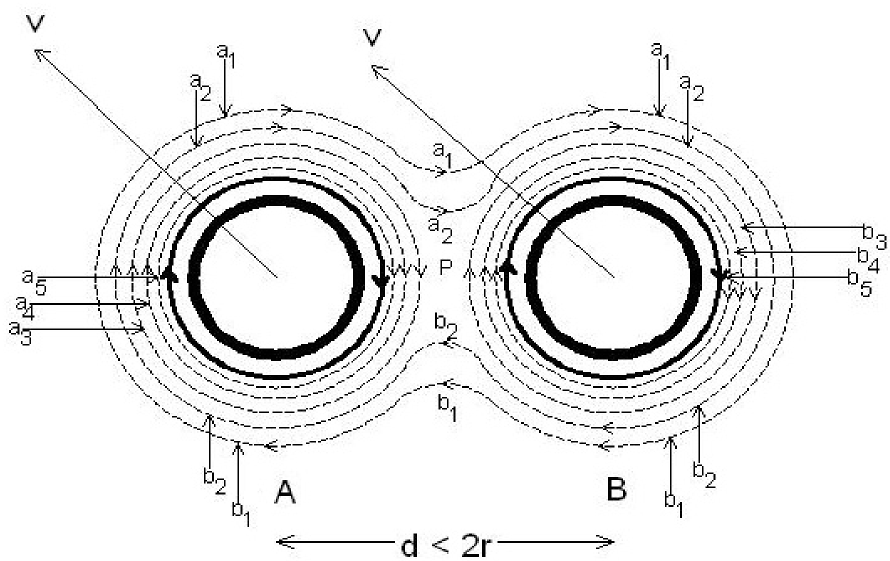
(a)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B
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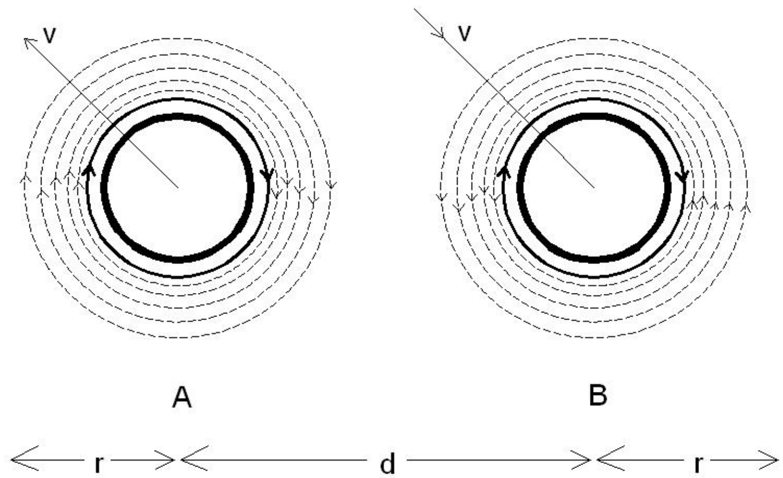
(b)

Fig. 2



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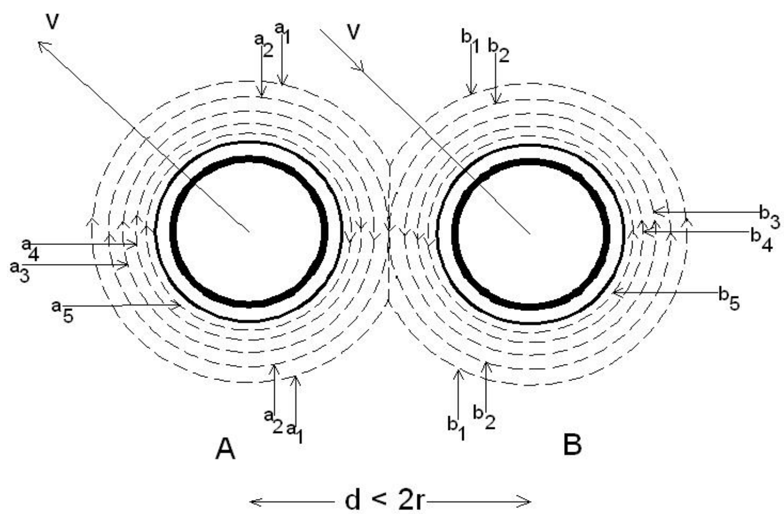

(b)

Fig. 3