UNDERSTANDING DEUTERONS, ALPHA PARTICLES AND NUCLEI: A NEW APPROACH

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Presently, a new theory has been proposed which gives very clear and almost complete understanding of deuterons, alpha (α) particles and nuclei, e.g.: 1. Why and how nature has provided us only deuteron, not di-proton and di-neutron while theoretically these are also possible; 2. Why and how binding energy per nucleon (E_b) of H^3 (tritium) and He^3 (helium) are increased to > $2\times E_b$ of deuteron, and E_b of $H^3 > E_b$ of He^3; 3. Why and how despite E_b of $H^3 > E_b$ of He^3, H^3 decays into He^3 through beta (β) decay; 4. How two-neutrons and two-protons are arranged in an α particle such that it persists and behaves like a particle and beams of α particles are obtained despite having repulsive Coulomb force between those; 5. Why and how E_b of α particle is increased to > $6\times E_b$ of deuteron, instead of increasing to $2\times E_b$ of deuteron; 6. How nucleons are arranged in nuclei having mass number A = integer multiple of 4 such that the nuclei become most strongly stable; 7. Why and how E_b of $Be^8 < E_b$ of He^4, while E_b of nuclei increases as their A increases in multiple of 4; 8. Why and how nuclei having A $\neq$ integer multiple of 4 are not strongly stable; 9. Why and how near A = 62, E_b is maximum and then it gradually decreases as A increases and ultimately for A > 200, the nuclei become radioactive and α, β, γ, ν are emitted from those; 10. How γ and ν obtain particle like physical existence and so high energy and penetrating power. Finally an important conclusion has also been drawn that the strength of stability of nucleus does not depend only upon E_b of nucleus but also upon the strength of stability of neutrons of nucleus, because the later one too varies.

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1. INTRODUCTION

Several theories have so far been proposed to explain nuclear structure, properties and phenomena etc. but very little is known about these. The reason behind it is that we never tried to find out the actual cause behind this.

It is very unfortunate that despite knowing that electrons, protons, neutrons etc. all possess spin motion and magnetic field, and due to interaction between their magnetic fields, the force of attraction or repulsion may be generated between these which may cause a charge independent force of attraction between nucleons in nuclei and a force of repulsion for ejection of α and β particles from the nuclei, we never tried to think over why do electrons, protons and neutrons all possess spin motion and magnetic field. The most unfortunate and surprising thing is that we did so despite knowing that in electron, proton beams, these are held together in their respective beams despite repulsive Coulomb force between these due to similar charge on these, which leads to conclude that in their beams, a charge independent force, stronger than the repulsive Coulomb force, is also generated that keeps electrons, protons etc. bound together in their respective beams against the repulsive Coulomb force. This charge independent and strong force should be generated due to interaction between their magnetic fields. Because, other than their magnetic field, there is no means through which this force can be generated.

Electrons, protons and neutrons all do not possess spin motion and magnetic field as a matter of chance or coincidence. There must positively be some purpose/reason behind it.

Presently, that purpose/reason has been determined (see Sec.3). It has also been determined that how electrons, protons, neutrons etc. obtain their spin motion and magnetic field (see Sec. 2). [The current concept that these obtain magnetic field due to spin motion of their charge is not true (for its confirmation, see Sec. 1, Ref. 1).] And consequently, the present theory gives very clear and almost complete understanding of deuterons, α particles and nuclei, e.g.: 1. Why and how nature has provided us only deuteron, not di-proton and di-neutron while theoretically these are also possible; 2. Why and how binding energy per nucleon (E_b) of H^3 (tritium) and He^3 (helium) are increased to > $2\times E_b$ of deuteron, and E_b of $H^3 > E_b$ of He^3; 3. Why and how despite E_b of $H^3 > E_b$ of He^3, H^3 decays into He^3 through β decay; 4. How two-neutrons and two-protons are arranged in an α particle such that it persists and behaves like a particle and beams of α particles are obtained despite having repulsive Coulomb force between them; 5. Why and how E_b of α particle is increased to > $6\times E_b$ of deuteron, instead of increasing to $2\times E_b$ of deuteron; 6. How nucleons are arranged in nuclei having mass number A = integer multiple of 4 such that the nuclei become most strongly stable; 7. Why and how E_b of $Be^8 < E_b$ of He^4, while E_b of nuclei increases as their A increases in multiple of 4; 8. Why and how nuclei having A$\neq$ integer multiple of 4 are not strongly stable; 9. Why and how near A = 62, E_b is maximum and then it gradually decreases as A increases and ultimately for A > 200, the nuclei become radioactive and α, β, γ, ν are emitted from them; 10. How γ and ν obtain particle like physical existence and so high energy and penetrating power.

Finally an important conclusion has also been drawn that the strength of stability of nucleus does not depend only upon E_b of the nucleus but also upon the strength of stability of neutrons in the nucleus, because the later one varies (see Sec. 5.7).

2. DETERMINATION OF HOW ELECTRONS, PROTONS AND NEUTRONS ALL POSSESS SPIN MOTION AND MAGNETIC FIELD

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

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. 1). 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.), 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 magnetism and charge of electron spin in directions opposite to each other because then their respective fields interact (electromagnetic interaction) with each other such that their spin motion in directions opposite to each other persists, and it keeps electron going on spinning persistently. (For detail and justification of its truth, see Sec. 3.1, Ref. 2.)

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

The magnetism and charge of proton both spin but in directions opposite to each. And the spin magnetic moment (μ_s), which the proton possesses, arises due to the spin motion of this magnetism, and occurs in the direction of its (magnetism) spin angular momentum.

The magnetism and charge of proton too spin in directions opposite to each other because then their respective fields interact (electromagnetic interaction) with each other such that their spin motion in directions opposite to each other persists, and it keeps proton going on spinning persistently.

About the structure of neutron, see Sec. 2, Ref. 3.

3. DETERMINATION OF PURPOSE WHY DO ELECTRONS, PROTONS AND NUCLEONS ALL POSSESS SPIN MOTION AND MAGNETIC FIELD

The spin motion of electrons, protons and neutrons generates two very important properties in these (see Sects. 3.1 and 3.2). And because of possessing magnetism by these, due to interaction between their magnetic fields, a strong, short range and charge independent force is also generated between these (see Sec. 3.3).

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. 4). Consequently, every spinning particle, e.g. electron, nucleon etc. possesses direction of its linear motion. By some means, e.g. applying some external force like electric or magnetic field on electrons, nucleons 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 if electric or magnetic field is applied across this, see Sec. 4.4, Ref. 1 and Sec. 5.4.1, Ref. 5).

3.2 Second property

If the frequency of spin motion of particle increases by some means, a stage comes when the particle starts moving itself along the direction of its L_S. Then, as the frequency of spin motion of particle increases, the velocity of particle, e.g., electron, proton etc. goes on increasing in accordance to expression[4]

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

[where m, v and ω respectively are the mass, linear velocity and frequency of spin motion of particle and h is Planck's constant, and for the verification of the truth of expression (1), see Sec. I A, Ref. 4].

Due to spin motion, the particle obtains spin energy ($E_s = h\omega/2$, for detail, see Sec. II, Ref. 4) and spin momentum ($p_S = h\omega/\mathrm{v}$, for detail, see Sec. II, Ref. 4) similarly as it obtains linear momentum (p_{lin}) corresponding to its kinetic energy (E_k). For the verification of truth of p_S, we can see Sec. I C, Ref. 4, and we can also take the example of photons, where $h\nu/c$, which is currently defined as momentum of photons, is in fact p_S of photons (for detail and confirmation, see Sec. 2.2, Ref. 6). It is generated due to spin motion of photons which they derive from the orbiting electrons from which they are emitted (for confirmation of its truth, see Sec. I A, Ref. 4).

Therefore, the particles possessing linear motion together with their spin motion, those possesses motional energy (E_m) $= E_k + E_s$, and motional momentum (p_m) = $p_{\mathrm{lin}} + p_S$, and whenever comes the situation of conservation of energy and momentum of such particle (i.e. possessing spin motion along with its linear motion), E_m and p_m of particle actually conserve, not its E_k and p_{lin} (for verification of the truth of conservation of p_m, see Sec. I D, Ref. 4).

3.3 The force that is generated between nucleons due to interaction between their magnetic fields

Since the nucleons possess magnetism, the generated two properties in these enable these to create such situation that, due to interaction between their magnetic fields, a short range, charge independent and very strong force is generated between these. This generated force has both the components attractive and repulsive, and it depends upon the situation created by the interacting particles accordingly attractive or repulsive component comes into play (for detail, see Ref. 7).

4. EXPLANATION OF WHY AND HOW NATURE HAS PROVIDED US ONLY DEUTERON (*NP*), NOT DI-PROTON (*PP*) AND DI-NEUTRON (*NN*) WHILE THEORETICALLY THESE ARE ALSO POSSIBLE

4.1 Explanation of how the separation of electron of a neutron is stopped from its (neutron) proton and it becomes stable in system, deuteron (*NP*)

In the structure of neutron (see Sec. 2.1, Ref. 3), say N_1, when the difference between spin angular momentum of magnetism (L_{sm}) and spin angular momentum of charge (L_{sc}), i.e. $L_{sm} - L_{sc}$ of its electron E_1 is increased as much that it (E_1), separating from proton P_1 (of neutron N_1), can move in the direction of its L_{sm} with velocity greater than the velocity of proton P_1 overcoming the attractive Coulomb force by the proton P_1 on it, it is separated from the proton and starts moving in the direction of its L_{sm} (for detail, see Sec. 2.1, Ref. 3). If by some means, the separation of electron E_1 from the proton P_1 is stopped, the electron E_1 can remain with proton, i.e. the neutron N_1 becomes stable. The separation of electron E_1 from proton P_1 can be stopped if during the process of reducing of L_{sc} of electron E_1 but before the difference (L_{sm} - L_{sc}) is increased as much that electron E_1 is separated from proton P_1, the effect of Coulomb force of attraction on electron E_1 by the proton P_1 is increased as much that the electron E_1 may not be separated from proton P_1.

The effect of Coulomb force of attraction of proton P_1 on electron E_1 can be increased if a proton P_2, moving parallel to neutron N_1 and in the same direction in which neutron N_1 is moving comes in the plane of proton P_1 (of neutron N_1) adjacent and so close to P_1 that the magnetic fields around protons P_2 and P_1 start interacting as shown in Fig. 2(b) (for detail, see Sec. 4.1, Ref. 7). Because then, due to +e charge on proton P_2, the effect of charge on proton P_1, which had earlier been decreased due to charge –e on electron E_1, is increased, and due to that, the attractive Coulomb force by proton P_1 on electron E_1 is increased. And consequently, electron E_1 is not being separated from proton P_1, i.e. neutron N_1 becomes stable.

Due to interaction between magnetic fields of protons P_1 and P_2 a binding force F [7] is also generated between protons P_1 P_2 and hence between N_1 P_2. Consequently, N_1 and P_2 are bound together, Fig. 2(b). The binding force F, say $F_{N_1 P_2}$ between N_1 and P_2 generates the total binding energy $(E_t)_D$ and the binding energy per nucleon $(E_b)_D$ of deuteron.

Further, when the protons P_1 and P_2 are bound together, proton P_2 increases the velocity of proton P_1 [which had earlier been reduced due to its (proton P_1) collision with electron E_1, see Sec. 2.1, Ref. 3] by dragging proton P_1 along with it and ultimately protons P_2 and P_1, and hence proton P_2 and neutron N_1 start moving with the same velocity, say v.

When the magnetic field around proton P_2 interacts with the magnetic field around proton P_1, a magnetic field around P_2 and P_1, and hence around P_2 and N_1, having direction as shown in Fig. 2(c), is generated.. Further, in deuteron (D), since both the nucleons (P_2 and N_1) acquire the same linear velocity v in the same direction and parallel to each other, Fig. 2(b), D too possesses its linear motion v in the same direction, Fig. 2(c).

4.2 Why and how system deuteron (*NP*) exists in nature while the system di-proton (*PP*) does not exist in nature

The force F is actually the resultant of two forces F_1 (attractive force caused due to interaction between the magnetisms of two particles) and F_2 (repulsive force caused due to interaction between the charges of two particles), i.e. $\boldsymbol{F = F_1 - F_2}$. Because nucleons possess electric and magnetic fields both, and hence F should be generated as the consequence of interaction between their both electric and magnetic fields. (For detail, see Sec.6.1, Ref. 7.)

In the case of system N_1P_2, in the force F generated between N_1P_2, i.e. in the force $F_{N_1P_2}$, due to charge –e on electron E_1, the effect of charge +e of proton P_1 is reduced and consequently the magnitude of component F_2 is reduced, say to F_2', in comparison to that if the effect of charge +e of proton P_1 would have not been reduced, i.e. if in place of neutron N_1, there would have been proton P_1. Due to reduction in the magnitude of component F_2

to F_2', the force $F_{N_1P_2}$ is obtained as $F_{N_1P_2} = F_1 - F_2'$. It happens to be $> F_{P_1P_2}$ (= $F_1 - F_2$). Because when in the system N_1P_2, N_1 is replaced by P_1, the system N_1P_2 is reduced to system P_1P_2. When the force $F_{N_1P_2}$ happens to be $> F_{P_1P_2}$, the nucleons N_1 and P_2 are more strongly bound with each other in system N_1P_2 in comparison to nucleons P_1 and P_2 in the system P_1P_2. The force $F_{P_1P_2}$ probably does not happen to be sufficient to keep bound nucleons P_1 and P_2 together in the system P_1P_2 persistently, it (P_1P_2) is not found in nature. Since the force $F_{N_1P_2} > F_{P_1P_2}$, it ($F_{N_1P_2}$) happens to be sufficient to keep bound nucleons N_1 and P_2 together in the system N_1P_2 persistently and consequently system N_1P_2 is found in nature. .

4.3 Why and how system di-neutron (*NN*) too does not exist in nature

In the system di-neutron (N_1N_2), since both the protons P_1 and P_2 are of neutrons N_1 and N_2 respectively, the effective + ve charges of both the protons P_1 and P_2 are reduced due to negative charges on their respective electrons E_1 and E_2. Consequently, the magnitude of component F_2 is reduced even more, say to F_2'', i.e. $F_2'' < F_2'$. So the force $F_{N_1N_2}$ happens to be even stronger than the force $F_{N_1P_2}$, i.e. $F_{N_1N_2} > F_{N_1P_2}$, and hence the system N_1N_2 too should be found existing in nature. But on the contrary, the system N_1N_2 is not found existing in nature. It happens so because, due to reduction in the effective + ve charges of both the protons P_1 and P_2 because of negative charges on their respective electrons E_1 and E_2, the effective + ve charge of proton P_1 fails to increase the effect of +ve charge of proton P_2 as much that proton P_2 may keep bound electron E_2 due to attractive Coulomb force. And similarly the effective + ve charge of proton P_2 fails to increase the effect of +ve charge of proton P_1 as much that proton P_1 may keep bound electron E_1 due to attractive Coulomb force. And consequently, both the neutrons N_1 and N_2 decay and there are left two protons P_1 and P_2 in place of two neutrons N_1 and N_2, i.e. the system N_1N_2 is reduced to system P_1P_2. In the system P_1P_2, since the force $F_{P_1P_2}$ does not happen to be sufficient to keep the protons P_1 and P_2 bound together, the system P_1P_2 and hence the system N_1N_2 fails to persist. Consequently, system N_1N_2 too is not found existing in nature.

5. EXPLANATION OF WHY AND HOW DUE TO ADDITION OF ONE PROTON (*P*) AND ONE NEUTRON (*N*) RESPECTIVELY IN THE SYSTEMS *NN* AND *PP*, THE RESULTANT SYSTEMS, i.e. NUCLEI OF H^3 AND He^3 BECOME STABLE AND THEIR E_b BECOME > 2×$(E_b)_D$; WHY AND HOW $(E_b)_{H^3} > (E_b)_{He^3}$ AND DESPITE $(E_b)_{H^3} > (E_b)_{He^3}$ HOW H^3 DECAYS INTO He^3 THROUGH β DECAY

5.1 Why and how due to the addition of one *P* in system *NN*, the resultant system, i.e. the nucleus of H^3 becomes stable, while the system *NN* is not stable

When a proton P is added in the system N_1N_2 and all the three nucleons are arranged in the same plane very close and adjacent to each other, as shown in Fig. 3(a), and these are having their linear motion v in the same direction and parallel to each other, the resultant system i.e. the nucleus of H^3 becomes stable. Because then, due to interaction between magnetic fields of proton P and proton P_1 of neutron N_1, and between magnetic fields of proton P and proton P_2 of neutron N_2, all the three nucleons are bound together in the form of a group, say T_1. And further, since the linear velocity of proton P happens to be > the linear velocities of protons P_1 and P_2 [because the linear velocities of protons P_1 and P_2 were reduced due to their collisions with their respective electrons E_1 (of neutron N_1) and E_2 (of neutron N_2), see Sec. 2.1, Ref. 3], the protons P_1 and P_2 are being dragged along with proton P. Consequently, the linear velocities of protons P_1 and P_2 are increased while that of proton P is decreased and ultimately these all acquire the same velocity v. And due to +ve charge on proton P, the effects of +ve charges on protons P_1 and P_2 which were earlier reduced due to effects of -ve charges on their respective electrons E_1 and E_2, are increased, and due these increase, the attractive Coulomb force by protons P_1 and P_2 on their respective electrons E_1 and E_2 are increased. Consequently, electrons E_1 and E_2 are not being separated from their respective protons P_1 and P_2 and neutrons N_1 and N_2 become stable.

When all the three nucleons are bound together in the form of a group T_1 and the neutrons N_1 and N_2 become stable, the whole system becomes stable.

Due to interaction between magnetic fields of protons P, P_1 and P_2, a magnetic field is generated around those, Fig. 3(c). The outer portion of the magnetic field obtained around those (i.e. group T_1) possesses the shape and direction as shown in Fig. 3(g). Further, in group T_1, since all the three nucleons P, N_1 and N_2 possess their linear velocity v in the same direction and parallel to each other, group T_1 too possesses its linear velocity v in the same direction.

5.2 Why and how E_b of the resultant system (nucleus of H^3) becomes $> 2\times(E_b)_D$

In the nucleus of H^3, when the neutrons N_1 and N_2 become stable, two deuterons D_1 (having nucleons P and N_1) and D_2 (having nucleons P and N_2) are created, Fig. 3(b), where proton P is common in both the deuterons D_1 and D_2. These two deuterons D_1 and D_2 are bound together at their one ends due to having common P between those. And at their other ends, those are bound together by the binding force generated between N_1 and N_2. The magnitude of this binding force depends upon how much neutrons N_1 and N_2 are close to each other. In the nucleus of H^3, the neutrons N_1 and N_2 are probably not found to be close enough, so the binding energy generated happens to be comparatively weak. Due to having common P between deuterons D_1 and D_2, since all the three nucleons N_1, N_2 and P are bound together, a binding energy is generated between those due to this too. Let the binding energy per nucleon (E_b) generated due to P being common be $=(E_b)_{d'}$. It may $=(E_b)_D$ or $>(E_b)_D$ but cannot be < $(E_b)_D$ [where $(E_b)_D$ is binding energy per nucleon of deuteron].

Therefore, the binding energy per nucleon (E_b) for nucleus of H^3, i.e. $(E_b)_{H^3}$ should be as follows:

$(E_b)_{H^3}$ = [Binding energy (B.E.) generated due to interaction between nucleons N_1 and P of deuteron D_1 + B.E. generated due to interaction between nucleons N_2 and P of deuteron D_2 + B.E. generated due to interaction among nucleons N_1, P and N_2 due to P being common between N_1 and N_2 + B.E. generated due to force $F_{N_1 N_2}$ between N_1 and N_2] / 3

= $[2(E_b)_{D_1} + 2(E_b)_{D_2} + 3(E_b)_{d'}$ + B.E. generated due to force $F_{N_1 N_2}$] / 3

= $[2(E_b)_D + 2(E_b)_D + 3(E_b)_{d'}$ + B.E. generated due to force $F_{N_1 N_2}$] / 3

= $4(E_b)_D /3 + (E_b)_{d'}$ + [B.E. generated due to force $F_{N_1 N_2}$] / 3 …… (5.1)

> $2(E_b)_D$ ……………………………………………………………… (5.2)

5.3 Why and how due to the addition of one *N* in system *PP*, the resultant system, i.e. the nucleus of He^3 becomes stable, while system *PP* is not stable

When a neutron N is added in the system P_1P_2 and all the three nucleons are arranged in the same plane, very close and adjacent to each other, as shown in Fig. 3(d), and these are having their linear motion in the same direction and parallel to each other, the resultant system i.e. the nucleus of He^3 becomes stable. Because then, due to interaction between the magnetic fields of protons P_1, P_2 and proton P of neutron N, all the three nucleons are bound together in the form of a group, say T_2. And further, since the linear velocities of protons P_1 and P_2 are happened to be > the linear velocity of proton P, proton P is being dragged along with protons P_1 and P_2. Consequently, the linear velocities of protons P_1 and P_2 are decreased while that of proton P is increased and ultimately these all acquire the same velocity v. And due to +ve charges on protons P_1 and P_2, the effect of +ve charge on proton P, which had earlier been reduced due to effect of -ve charge on electron E (of neutron N), is increased, and due this increase, the attractive Coulomb force by proton P on electron E is increased. Consequently, electron E is not being separated from proton P and neutron N becomes stable.

When all the three nucleons are bound together in the form of a group T_2 and neutron N becomes stable, the whole system becomes stable.

Due to interaction between magnetic fields of protons P, P_1 and P_2, a magnetic field is also generated around these, Fig. 3(f). The outer portion of the magnetic field obtained around these (i.e. group T_2) possesses the shape and direction as shown in Fig. 3(g). Further, in group T_2, since all the three nucleons N, P_1 and P_2 possess their linear velocity v in the same direction and parallel to each other, group T_2 too possesses its linear velocity v in the same direction.

5.4 Why and how E_b of the resultant system (nucleus of He^3) becomes $> 2 \times (E_b)_D$

In the nucleus of He^3, Fig. 3(d), when the neutron N becomes stable, two deuterons D_1 (having nucleons P_1 and N) and D_2 (having nucleons P_2 and N) are created, Fig. 3(b), where neutron N is common in both the deuterons D_1 and D_2. These two deuterons D_1 and D_2 are bound together at their one ends due to having common N between these. And at their other ends, these are bound together by the binding force generated between P_1 and P_2. The magnitude of this binding force depends upon how much protons P_1 and P_2 are close to each other. Presently, i.e. in the nucleus of He^3, protons P_1 and P_2 are probably not found to be close enough, so the binding energy generated happens to be comparatively weak. Due to having common N between deuterons D_1 and D_2, since all the three nucleons P_1, P_2 and N are bound together, a binding energy is generated between these due to this too. Let the binding energy per nucleon (E_b) generated due to N being common be $= (E_b)_{d''}$. It may $= (E_b)_D$ or $> (E_b)_D$ but cannot be $<$ $(E_b)_D$ [where $(E_b)_D$ is binding energy per nucleon of deuteron].

Therefore, the binding energy per nucleon (E_b) for nucleus of He^3, i.e. $(E_b)_{He^3}$ should be as follows:

$(E_b)_{He^3}$ = [Binding energy (B.E.) generated due to interaction between nucleons P_1 and N of deuteron D_1 + B.E. generated due to interaction between nucleons P_2 and N of deuteron D_2 + B.E. generated due to interaction among nucleons P_1, N and P_2 due to N being common between P_1 and P_2 +

B.E. generated due to force $F_{P_1 P_2}$ between P_1 and P_2] / 3

$= \; [2\,(E_b)_{D_1} + 2\,(E_b)_{D_2} + 3\,(E_b)_{d''}$ + B.E. generated due to force $F_{P_1 P_2}$] / 3

$= \; [2\,(E_b)_D + 2\,(E_b)_D + 3\,(E_b)_{d''}$ + B.E. generated due to force $F_{P_1 P_2}$] / 3

$= \; 4\,(E_b)_D/3 + (E_b)_{d''}$ + [B.E. generated due to force $F_{P_1 P_2}$] / 3 ……… (5.3)

$> \; 2\,(E_b)_D$ ……………………………………………………………. (5.4)

5.5 Why and how $(E_b)_{H^3} > (E_b)_{He^3}$

If we compare the expressions for E_b of H^3 and He^3, i.e. expressions (5.1) and (5.3), we find that in these expressions, the last two terms are different. The second term $(E_b)_{d'}$ happens to be $> (E_b)_{d''}$. Because in the nucleus of H^3, the effective +ve charge of its two protons P_1 and P_2 is reduced due to –ve charges of its electrons E_1 and E_2 which subsequently causes decrease in the magnitude of F_2 of force F between nucleons $P\ N_1$ and between $P\ N_2$, while in the nucleus of He^3, the effective +ve charge of its single proton P is reduced due to –ve charges of its electrons E which subsequently causes decrease in the magnitude of F_2 of force F between nucleons $N\ P_1$ and between $N\ P_2$, then obviously, the decrease in the magnitude of F_2 in the former case (i.e. in H^3) happens to be > the decrease in the magnitude of F_2 in the later case (i.e. in He^3). Consequently, the force F between nucleons $P\ N_1$ and between $P\ N_2$ and hence $(E_b)_{d'}$ happens to be $> (E_b)_{d''}$.

Regarding the last term in expressions (5.1) and (5.3), since $F_{N_1 N_2} > F_{N_1 P_2}$ (see Sec.4.3) and $F_{N_1 P_2} > F_{P_1 P_2}$ (see Sec. 4.2), $F_{N_1 N_2}$ shall be $> F_{P_1 P_2}$ and hence E_b (generated due to force $F_{N_1N_2}$) shall also be > E_b (generated due to force $F_{P_1P_2}$). But in the nucleus H^3, its nucleons N_1 and N_2, and in the nucleus He^3, its nucleons P_1 and P_2 respectively are probably not happened to be as much close as nucleons are in deuterons. So E_b (generated due to force $F_{N_1N_2}$) does not happen to be $>(E_b)_D$, instead it happens to be $<(E_b)_D$. And E_b (generated due to force $F_{P_1P_2}$) happens to be even lesser.

So $(E_b)_{H^3}$ (= 2.8273 MeV[8]) is found to be > $(E_b)_{He^3}$ (= 2.5627 MeV[8]).

5.6 Despite $(E_b)_{H^3} > (E_b)_{He^3}$, why and how H^3 is radioactive and decays into He^3 through β decay

In the nucleus of H^3, Fig. 3(a), due to +ve charge on a single proton P, the effects of +ve charges on two protons P_1 and P_2, which had earlier been reduced due to effects of -ve charges on their respective electrons E_1 and E_2, are increased, and due these increase, the attractive Coulomb force by protons P_1 and P_2 on their electrons E_1 and E_2 are increased (see Sec. 5.1). While in the nucleus of He^3, Fig. 3(d), due to +ve charges on two protons P_1 and P_2, the effect of +ve charge on a single proton P, which had earlier been reduced due to effect of -ve charge on electron E, is increased, and due this increase, the attractive Coulomb force by proton P on electron E is increased (see Sec. 5.3). Then obviously, in the nucleus of He^3, neutron N happens to be more strongly stable while neutrons N_1 and N_2 in the nucleus of H^3 are happened to be weakly stable. And consequently, despite $(E_b)_{H^3} > (E_b)_{He^3}$, H^3 happens to be radioactive and decays into He^3 through β decay.

5.7 An important Conclusion

The decay of H^3 into He^3 through β decay, despite $(E_b)_{H^3} > (E_b)_{He^3}$, gives an important conclusion that the strength of stability of a nucleus does not depend only upon its E_b but also upon the strength of stability of its neutrons.

The half-lives of isotope $Li^4\,(=9.1\times10^{-23}\,\text{s}^{9})$ and of the synthesized isotope $H^4\,(=1.39\times10^{-22}\,\text{s}^{10})$ confirm the above conclusion. The three-protons (P_1, P_2, P_3) of isotope Li^4, Fig. 3(h and i), make its one-neutron (N) very strongly stable but three interacting binding forces ($F_{P_1P_2}$, $F_{P_2P_3}$, $F_{P_1P_3}$) make the binding among its three protons and hence among its four nucleons very weak, consequently its half-life is reduced to 9.1×10^{-23} s and emitting a proton it decays into He^3 (see Ref. 8). And in isotope H^4, Fig. 3(j and k), its one-proton (P) fails to make its three-neutrons (N_1, N_2, N_3) stable, consequently even having very strong binding among its all the four nucleons due to the interacting forces ($F_{N_1N_2}$, $F_{N_2N_3}$, $F_{N_1N_3}$), isotope H^4 does not exist in nature. The half-life of the synthesized isotope H^4 happens to be very short $=1.39\times10^{-22}$ s and emitting a neutron, it decays into H^3 (see Ref. 10).

6. EXPLANATION OF HOW TWO-NEUTRONS AND TWO-PROTONS ARE ARRANGED IN AN ALPHA PARTICLE SUCH THAT IT PERSISTS AND BEHAVES LIKE A PARTICLE, HOW BEAMS OF ALPHA PARTICLES ARE OBTAINED, AND WHY AND HOW E_b OF ALPHA PARTICLE IS INCREASED TO > 6$(E_b)_D$ INSTEAD OF INCREASING TO 2$(E_b)_D$

6.1 How two-neutrons and two-protons are arranged in an alpha particle such that it persists and behaves like a particle, and how beams of alpha particles are obtained despite having repulsive Coulomb force between these

In the structure of α particle, two neutrons N_1, N_2 and two protons P_1, P_2 are arranged as shown in Fig. 4(a), and all the four nucleons possess their linear velocity v in the same direction and parallel to each other. In this structure, we observe: i- The pair of one-proton and one-neutron P_1 N_1 behaves like deuteron D_1, and similarly the pair of N_1 P_2 behaves like deuteron D_2, the pair of P_2 N_2 behaves like deuteron D_3, and the pair of N_2 P_1 behaves like deuteron D_4, Fig. 4(b); ii- Every combination of two-protons and one-neutron, i.e. P_1 N_1 P_2 and P_2 N_2 P_1 behaves like a group T_2, Fig. 4(c); and iii- Every combination of two-neutrons and one-proton, i.e. N_1 P_2 N_2 and N_2 P_1 N_1 behaves like a group T_1, Fig. 4(d). And as in the case of nucleus of He^3 (i.e. group T_2), its neutron N happens to be strongly stable, similarly in the combinations- P_1 N_1 P_2 and P_2 N_2 P_1 of α particle, neutrons N_1 and N_2 are happened to be strongly stable. And, as in the case of nucleus of H^3 (i.e. group T_1), since its all the three nucleons are strongly bound with each other, similarly in every combination- N_1 P_2 N_2 and N_2 P_1 N_1 of α particle, all the three nucleons are strongly bound with each other. And thus, in a α particle, it's both the neutrons are very strongly stable and all the four nucleons are very strongly bound with each other. Consequently, an alpha particle, despite being a combination of four nucleons, behaves like a single particle. Further, in α particle, since all its four nucleons possess their linear velocity v in the same direction, α particle too possesses its linear velocity v in the same direction.

In α particle, due to interaction between magnetic fields of all its four nucleons, a magnetic field is generated around these, say group G, Fig. 4(e). The outer portion of the magnetic field obtained around these possesses the shape and direction as shown in Fig. 4(f). The shape and direction of magnetic field obtained around α particle, Fig. 4(f), are happened to be similar as obtained around an electron, Fig. 1(b). And consequently α particles behave just like electrons, protons etc., and their beams are obtained despite having repulsive Coulomb force between those similarly as electron beams are obtained despite having repulsive Coulomb force between those (see Sec. 5, Ref. 7).

6.2 Why and how E_b of α particle is increased to > $6\times(E_b)_D$ instead of increasing to $2\times(E_b)_D$

In the structure of α particle, the nucleons P_1, N_1, P_2 and N_2 are bound together by three types of binding energies generated among these due to: 1. Interactions between P_1 and N_1, between N_1 and P_2, between P_2 and N_2, and between N_2 and P_1; 2. Interactions among P_1, N_1, P_2 because of N_1 being common between P_1 and P_2, among N_1, P_2, N_2 because of P_2 being common between N_1 and N_2, among P_2, N_2, P_1 because of N_2 being common between P_2 and P_1, and among N_2, P_1, N_1 because of P_1 being common between N_2 and N_1; 3. Interactions between P_1 and P_2, and between N_1 and N_2.

Therefore, the binding energy per nucleon (E_b) generated among nucleons P_1, N_1, P_2 and N_2 of α particle, i.e. $(E_b)_\alpha$ should be as follows:

$(E_b)_\alpha$ = [Binding energy (B.E.) generated due to interaction between nucleons P_1 and N_1 of deuteron D_1 + B.E. generated due to interaction between nucleons N_1 and P_2 of deuteron D_2 + B.E. generated due to interaction between nucleons P_2 and N_2 of deuteron D_3 + B.E. generated due to interaction between nucleons N_2 and P_1 of deuteron D_4 + B.E. generated due to interaction among nucleons P_1, N_1 and P_2 due to N_1 being common between

P_1 and P_2 + B.E. generated due to interaction among nucleons N_1, P_2 and N_2 due to P_2 being common between N_1 and N_2 + B.E. generated due to interaction among nucleons P_2, N_2 and P_1 due to N_2 being common between P_2 and P_1 + B.E. generated due to interaction among nucleons N_2, P_1 and N_1 due to P_1 being common between N_2 and N_1 + B.E. generated due to force $F_{P_1P_2}$ between P_1 and P_2 + B.E. generated due to force $F_{N_1N_2}$ between N_1 and N_2] / 4

$$= [2(E_b)_{D_1} + 2(E_b)_{D_2} + 2(E_b)_{D_3} + 2(E_b)_{D_4} + 3(E_b)_{d''} + 3(E_b)_{d'} + 3(E_b)_{d''} + 3(E_b)_{d'} + 2(E_b)_{N_1N_2} + 2(E_b)_{P_1P_2}] / 4$$

$$= [2(E_b)_D + 2(E_b)_D + 2(E_b)_D + 2(E_b)_D + 6(E_b)_{d''} + 6(E_b)_{d'} + 2(E_b)_{N_1N_2} + 2(E_b)_{P_1P_2}]/4$$

$$= [8(E_b)_D + 6(E_b)_{d''} + 6(E_b)_{d'} + 2(E_b)_{N_1N_2} + 2(E_b)_{P_1P_2}] /4$$

In the above expression, $(E_b)_{d''}$ may be $= (E_b)_D$ or $> (E_b)_D$ but cannot be $< (E_b)_D$, and $(E_b)_{d'}$ happens to be > $(E_b)_{d''}$ (see Sec. 5.5). And in α particle, since all its four nucleons are very close and compactly packed, $F_{N_1N_2}$ and hence $(E_b)_{N_1N_2}$ may happen to be $> (E_b)_D$ or = $(E_b)_D$ [see Sec. 4.3]. But $(E_b)_{P_1P_2}$ can neither be $> (E_b)_D$ nor can be $= (E_b)_D$. It shall be $< (E_b)_D$ [see Sec. 4.2]. Therefore the above expression reduces to

$$(E_b)_\alpha > 6(E_b)_D \qquad \text{(6)}$$

7. EXPLANATION OF HOW NUCLEONS ARE ARRANGED IN NUCLEI HAVING A = INTEGER MULTIPLE OF 4 SUCH THAT THEY (NUCLEI) ARE

MOST STRONGLY STABLE, HOW THEIR E_b INCREASES AS THEIR A INCREASES IN MULTIPLE OF 4, AND HOW E_b OF Be^8 IS REDUCED TO < E_b OF He^4 WHILE A OF Be^8 = 2×A OF He^4

In nuclei with mass number (A) integer multiple of 4, such as $He^4, Be^8, C^{12}, O^{16}$, Ne^{20} etc., the nucleons are arranged forming groups (G), each group having 4 nucleons, two protons and two neutrons. In every group, two protons and two neutrons are arranged exactly in the same manner as arranged in a α particle, Fig. 4(a), and the directions of linear velocity of all the four nucleons, lie in the same direction and parallel to each other. And hence, every group G in every nucleus possesses its linear velocity in the direction of linear velocity of its nucleons.

7.1 How nucleons are arranged in a nucleus having A = 4 (i.e. He^4), and determination of its E_b

In the nucleus of He^4, there occurs only one group G, and two neutrons and two protons are arranged in that group in the same manner as these are arranged in a α particle. And hence, the nucleus of He^4 has same E_b as a α particle has.

7.2 How nucleons are arranged in a nucleus having A = 8 (i.e. Be^8), and determination of its E_b

In the nucleus of Be^8, there occur two groups G_1 and G_2 (each having 4 nucleons) and these are arranged, as shown in Fig. 5(a). Group G_1 possesses its linear velocity along +X direction and group G_2 along –X direction. Due to having linear velocities by the groups G_1 and G_2 towards each other, these try to come close to each other, but due to having +2e charges on these, the repulsive Coulomb force between these does not allow these to do so. When the forces on these due to their linear velocities and due to Coulomb repulsion become equal to each other, these stop coming close to each other and thus a certain distance, say d, is set between these as shown in Fig. 5(a).

Due to having linear velocities by the groups G_1 and G_2 along +X and –X directions, the magnetic fields generated around these groups G_1 and G_2 occur in planes parallel to each other (because magnetic fields generated around these groups occur in Y Z plane). And the directions of magnetic fields around these lie in directions opposite to each other, as shown by round arrows in their centers, Fig. 5(a).

Since the magnetic fields around the groups G_1 and G_2 occur in planes parallel to each other, their magnetic fields do not interact with each other and hence no binding force is generated between the groups G_1 and G_2 due to interaction between their magnetic fields. Therefore, (E_b) for the nucleus of Be^8, i.e. $(E_b)_{Be}$, happens to be as follows:

$(E_b)_{Be}$ = [E_t (i.e. total binding energy) of group G_1 + E_t of group G_2] / 8

= E_t of group G /4

because E_t of all the groups $G_1, G_2, G_3, \ldots$.. are equal, can say $= E_t$. Therefore,

$$(E_b)_{Be} = (E_b)_{He} \quad \ldots\ldots \qquad (7.1)$$

where $(E_b)_{He}$ is the binding energy per nucleon (E_b) for the nucleus of He^4 .

7.2.1 Why and how E_b of nuclei of Be^8 < E_b of nuclei of He^4

To overcome the repulsive Coulomb force between groups G_1 and G_2 , since the groups G_1 and G_2 lose their some energy, their binding energies [i.e. E_t of group G_1 and E_t of group G_2] are reduced. And hence $(E_b)_{Be}$ is also reduced. Consequently, $(E_b)_{Be}$ happens to be a little $< (E_b)_{He}$.

7.3 How nucleons are arranged in a nucleus having A = 12 (C^{12}) and its E_b is increased to > E_b of He^4

In the nucleus of C^{12}, there occur three groups G_1, G_2, G_3 and these are arranged as shown in Fig. 5(b), where the groups G_1, G_2 are arranged exactly as these are arranged in the nucleus of Be^8. The additional group G_3 possesses its linear velocity along –Y direction and hence the magnetic field around it occurs in X Z plane. The magnetic field around group G_3 possesses direction as shown by round arrow in its centre, Fig. 5(b).

The portion of magnetic field around group G_3 lying towards our left hand side, Fig. 5(b), interacts with the magnetic field around group G_1. And the portion of magnetic field around group G_3 lying towards our right hand side interacts with the magnetic field around group G_2. Because of having directions by the magnetic fields around the groups G_1, G_2, G_3, as shown by round arrows in their centers, Fig. 5(b), the interactions between magnetic fields of groups G_1, G_3, and between the magnetic fields of the groups G_2, G_3, are happened to be attractive (for verification of its truth, see Sec. 7.9). Consequently, the left side of group G_3 is bound with group G_1, and similarly the right side of group G_3 is bound with group G_2. And thus, the groups G_1 and G_2 are bound with each other through the group G_3.

When, in the nucleus of C^{12}, all the three groups are bound together, all the 12 nucleons are also bound and hence $(E_b)_C$ is obtained as follows:

$(E_b)_C$ = [(E_t of group G_1 + E_t of group G_2 + E_t of group G_3) + B.E. generated due to interaction between magnetic fields around groups $G_1 \& G_3$ + B.E. generated due to interaction between magnetic fields around groups $G_2 \& G_3$] / 12

= [$3\times E_t$ of group G + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)] / 12

= E_t of group G /4 + [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)] / 12

= $(E_b)_{He}$ + [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)] / 12………………… (7.2)

> $(E_b)_{He}$ ……………………………………………………………… (7.3)

7.4 How nucleons are arranged in a nucleus having A = 16 (O^{16}) and its E_b is increased to > E_b of C^{12}

In the nucleus of O^{16}, there occur four groups G_1, G_2, G_3, G_4 and these are arranged as shown in Fig. 5(c). The groups G_1, G_2, G_3 are arranged exactly as these are arranged in the nucleus of C^{12}, and hence the directions of their linear velocities, planes and directions of their magnetic fields too are arranged exactly as these are arranged in the nucleus of C^{12}. The groups G_1, G_2, G_3 are bound together due to interactions between their magnetic fields exactly as these are bound together in the nucleus of C^{12} due to interactions between their magnetic fields.

The additional group G_4 possesses its linear velocity along +Y direction, and the magnetic field around it occurs in X Z plane and possesses direction as shown by round arrow in the center of group G_4, Fig. 5(c). The portion of magnetic field around group G_4, occurring on our left hand side, interacts with the magnetic field around group G_1. And similarly the portion of magnetic field around group G_4, occurring on our right hand side, interacts with the magnetic fields around group G_2. Consequently, the left and right sides of group G_4 are bound respectively with group G_1 and group G_2. Thus, all the four groups G_1, G_2, G_3, G_4 and hence all the 16 nucleons are bound together (for verification of its truth, see Sec. 7.9).

Therefore, $(E_b)_O$ is obtained as follows:

$(E_b)_O$ = [(E_t of group G_1 + E_t of group G_2 + E_t of group G_3 + E_t of group G_4) + B.E. generated due to interaction between magnetic fields around groups G_1 & G_3 + B.E. generated due to interaction between magnetic fields around groups G_2 & G_3 + B.E. generated due to interaction between magnetic fields around groups G_1 & G_4 + B.E. generated due to interaction between magnetic fields around groups G_2 & G_4)] / 16

= E_t of group G /4 + [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)] / 16

= $(E_b)_{He}$ + [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 +groups G_2 & G_3 +groups G_1 & G_4 +groups G_2 & G_4)]/16 (7.4)

= [$(E_b)_{He}$ + {B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)}/12] – [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)]/48 + [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_4 + groups G_2 & G_4)] / 16

$= (E_b)_C -$ [B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_3 +$ groups $G_2 \& G_3$)]/48 + [B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_4 +$ groups $G_2 \& G_4$)] / 16………………………………………………… (7.5)

Because from expression (7.2), $(E_b)_{He} +$ (B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_3 +$ groups $G_2 \& G_3$)/12 $= (E_b)_C$.

Therefore,

$(E_b)_O > (E_b)_C$ ………………………………………………………… (7.6)

Because in expression (7.5), B.E. generated due to interaction between magnetic fields around (groups $G_1 \& G_4 +$ groups $G_2 \& G_4$)/16 can never be $\leq$B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_3 +$ groups $G_2 \& G_3$) /48

7.5 How nucleons are arranged in a nucleus having A = 20 (Ne^{20}) and its E_b is increased to > E_b of O^{16}

In the nucleus of Ne^{20}, there occur five groups G_1, G_2, G_3, G_4, G_5 and these are arranged as shown in Fig. 5(d), where the groups G_1, G_2, G_3, G_4 are arranged exactly as these are arranged in the nucleus of O^{16}. The additional group G_5 possesses its linear velocity along +Z direction and the magnetic field around it occurs in X Y plane and possesses direction as shown by round arrow in the center of group G_5, Fig. 7(d). The portions of the magnetic field around group G_5, occurring on our left hand side, on our right hand side, on our front side, and on opposite to our front side interact with the magnetic fields around group G_1, group G_2, group G_3, and group G_4 respectively. Consequently, all the four sides of group G_5, lying towards our left hand side, right hand side, front side, and opposite to front side are bound respectively with group G_1, group G_2, group G_3, and group G_4. Thus, all the five groups G_1, G_2, G_3, G_4, G_5 and hence all the 20 nucleons are bound together (for verification of its truth, see Sec. 7.9).

Therefore, $(E_b)_{Ne}$ is obtained as follows:

$(E_b)_{Ne}$ =[(E_t of group G_1 + E_t of group G_2 + E_t of group G_3 + E_t of group G_4 + E_t of group G_5) + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)} + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)}] / 20

= E_t of group G /4 + [{B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)} + { B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)}] / 20

= $(E_b)_{He}$ + [{B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)} + { B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)}]/20… (7.7)

= [$(E_b)_{He}$ + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)}/16] –

[B.E. generated due to interaction between magnetic fields around (groups $G_1 \& G_3$ + groups $G_2 \& G_3$ + groups $G_1 \& G_4$ + groups $G_2 \& G_4$)] / 80 + [B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_5$ + groups $G_2 \& G_5$ + groups $G_3 \& G_5$ + groups $G_4 \& G_5$)] / 20

= $(E_b)_O$ – [B.E. generated due to interaction between magnetic fields around (groups $G_1 \& G_3$ + groups $G_2 \& G_3$ + groups $G_1 \& G_4$ + groups $G_2 \& G_4$)]/80 + [B.E. generated due to interaction between magnetic fields around (groups $G_1 \& G_5$ + groups $G_2 \& G_5$ + groups $G_3 \& G_5$ + groups $G_4 \& G_5$)]/20….. (7.8)

Because from expression (7.4), [$(E_b)_{He}$ + {B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_3$ + groups $G_2 \& G_3$ + groups $G_1 \& G_4$ + groups $G_2 \& G_4$)}/16] $= (E_b)_O$.

Therefore,

$(E_b)_{Ne} > (E_b)_O$ …………………………………………………………… (7.9)

because in expression (7.8), [B.E. generated due to interaction between magnetic fields around (groups $G_1 \& G_5$ + groups $G_2 \& G_5$ + groups $G_3 \& G_5$ + groups $G_4 \& G_5$)] /20 can never be $\leq$[B.E. generated due to interaction between the magnetic fields around (groups $G_1 \& G_3$ + groups $G_2 \& G_3$ + groups $G_1 \& G_4$ + groups $G_2 \& G_4$)] /80

7.6 How nucleons are arranged in a nucleus having A = 24 (Mg^{24}) and its E_b is increased to > E_b of Ne^{20}

In the nucleus of Mg^{24}, there occur six groups $G_1, G_2, G_3, G_4, G_5, G_6$ and these are arranged as shown in Fig. 5(e),where the groups G_1, G_2, G_3, G_4, G_5 are arranged exactly as these are arranged in the nucleus of Ne^{20}. The additional group G_6 possesses its linear velocity along - Z direction and the magnetic field around it occurs in X Y plane and possesses direction as shown by round arrow in the center of group G_6, Fig. 5(e). The portions of the magnetic field around group G_6, occurring on our left hand side, right hand side, on our front side, and on opposite to our front side interact with the magnetic fields around group G_1, group G_2, group G_3, and group G_4 respectively. Consequently, the sides of group G_6, lying towards our left hand side, right hand side, front side, and opposite to our front side are bound respectively with group G_1, group G_2, group G_3, and group G_4. In this way, all the six groups $G_1, G_2, G_3, G_4, G_5, G_6$ and hence all the 24 nucleons are bound together (for verification of its truth, see Sec. 7.9).

Therefore, $(E_b)_{Mg}$ is obtained as follows:

$(E_b)_{Mg}$ = [(E_t of group G_1 + E_t of group G_2 + E_t of group G_3 + E_t of group G_4 + E_t of group G_5 + E_t of group G_6) + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4)} + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)} + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_6 + groups G_2 & G_6 + groups G_3 & G_6 + groups G_4 & G_6)}] /24

= E_t of group G /4 + [{B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups

G_2 & G_4)} + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)} + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_6 + groups G_2 & G_6 + groups G_3 & G_6 + groups G_4 & G_6)}] /24

= [$(E_b)_{He}$ + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4) + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)}/20] – [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 +groups G_1 & G_4 +groups G_2 & G_4)+ B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)/120 + [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_6 + groups G_2 & G_6 + groups G_3 & G_6 + groups G_4 & G_6)] /24

= $(E_b)_{Ne}$ - [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4) + B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)]/120 + [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_6 + groups G_2 & G_6 + groups G_3 & G_6 + groups G_4 & G_6)] /24 ……………………………………….. (7.10)

because from expression (7.7), $(E_b)_{He}$ + {B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3 + groups G_1 & G_4 + groups G_2 & G_4) + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)}/20 = $(E_b)_{Ne}$.

Therefore,

$(E_b)_{Mg} > (E_b)_{Ne}$ ……………………………………………… (7.11)

because in expression (7.10), [B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_6 + groups G_2 & G_6 + groups G_3 & G_6 + groups G_4 & G_6)] /24 can never be $\leq$ [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 +groups G_2 & G_3 +groups G_1 & G_4 +groups G_2 & G_4)+ B.E. generated due to interaction between magnetic fields around (groups G_1 & G_5 + groups G_2 & G_5 + groups G_3 & G_5 + groups G_4 & G_5)] /120

7.7 How nucleons are arranged in nuclei having A = 28, 32, 36, 40 etc. and their E_b increases

In the nucleus having 28 nucleons, the nucleons are grouped in 7 groups $G_1, G_2, G_3, G_4, G_5, G_6, G_7$. Six groups $G_1, G_2, G_3, G_4, G_5, G_6$ are arranged as shown in Fig. 5(e) and seventh group G_7 can be arranged behind any of the six groups $G_1, G_2, G_3, G_4, G_5, G_6$. Let us assume that group G_7 is arranged behind group G_1. Then the direction of linear velocity of group G_7 lies in the same direction in which the direction of linear velocity of group G_1 lies, the plane of magnetic field around group G_7 lies in plane parallel to the plane of magnetic field around group G_1 and the of direction of magnetic field around group G_7 lies in the same directions in which the direction of magnetic field around group G_1 lies. If group G_7 is arranged behind group G_2 , the direction of linear velocity of group G_7 lies in the same direction in which the direction of linear motion of group G_2 lies, the plane of magnetic field around group G_7 is parallel to the plane of magnetic field around group G_2 and the direction of magnetic field around group G_7 lies in the same directions in which the direction of magnetic field around group G_2 lies and so on. When group G_7 is arranged behind any group G_1 or G_2 or $G_3 \ldots$, due to having repulsive Coulomb force between groups, group G_7 is not set behind group G_1 or G_2 or $G_3 \ldots$ touching that, but is set at some distance apart from that. Suppose the group G_7 is arranged behind group G_1. Therefore, Since group G_7 is set behind group G_1, outer portions (or can say, weaker portions) of magnetic fields occurring around the groups G_3, G_4, G_5, G_6, which are left free from interaction with the magnetic field occurring around group G_1, are available to interact with the magnetic field occurring around group G_7 . And consequently, group G_7 is bound with the groups G_3, G_4, G_5, G_6, but with lesser binding force in comparison to that with which group G_1 is bound. And hence, E_b of the nucleus (having A = 28) is increased but with reduced magnitude. Similarly, as A of the nucleus increases by integer multiple of 4, the number of G type groups goes on increasing one by one and these go on setting behind the groups G_2 , G_3, G_4 , G_5, G_6 and so on, and accordingly E_b of the nucleus goes on increasing. It goes on till A becomes = 48. When A increases beyond 48 (by integer multiple of 4), the groups start setting behind the groups G_7 , G_8 , G_9 and so on till A becomes = 72. But when A increases beyond 48, the rate of increase in E_b is reduced further and near A = 62, it becomes minimum. So, near A = 62, E_b after attaining its maximum value, starts decreasing as A increases (why and how it starts decreasing, see Sec. 9).

7.8 Why and how nuclei having A = integer multiple of 4, are most strongly stable

As have been described above in Sec. 7.1 to 7.7, in all the nuclei of He^4 , Be^8 , C^{12} , O^{16} , Ne^{20} etc., the nucleons are arranged forming groups G , where each group G itself is very strongly stable, and secondly, when G groups (two, three, four and so on) are arranged, due to interaction between their magnetic fields, a strong binding is generated between groups and hence between nucleons. While if other groups D , T_1 , T_2 are also arranged (see Sec. 8), due to interaction between their magnetic fields, loose bindings are generated between those and hence between nucleons. Consequently, nuclei having A = integer multiple of 4, are most strongly stable.

7.9 Experimental verification of the truth of binding of groups *G₁*, *G₂*, *G₃* etc. with each other due to interaction between their magnetic fields

Exactly as group G of four nucleons arranged as described in Sec. 6.1, let us assume group H of four electric current carrying very small pieces of rods, and two, three, four, five and six H groups are arranged as two, three, four, five and six G groups are arranged in Figs. 5(a), 5(b), 5(c), 5(d) and 5(d) respectively. If we allow the flow of electric current through each rod of every group H and such that electrons obtain the direction of their velocity exactly in the same direction in which each nucleon of every group G possess, all the four rods of each group H shall be bound together, and in the case when there are only two groups, no binding between the groups shall be observed. In the cases when there are three, four, five and six H groups, a binding shall be observed between the groups, and the binding energy shall go on increasing as number of groups increases from two to three, four, five and six.

8. HOW NUCLEONS ARE ARRANGED IN NUCLEI HAVING A ≠ INTEGER MULTIPLE OF 4 (e.g. Li^6, Li^7, B^{11} and N^{14}) SUCH THAT THESE ARE NOT STRONGLY STABLE, HOW E_b OF Li^6 AND Li^7 ARE REDUCED TO < E_b OF He^4, E_b OF B^{11} TO < E_b OF Be^8, AND E_b OF N^{14} TO < E_b OF C^{12} WHILE E_b OF NUCLEI INCREASES AS THEIR A INCREASES

8.1 How nucleons are arranged in the nuclei of Li^6, Li^7 such that their (Li^6, Li^7) E_b increase as their A increases but are happened to be < E_b of He^4

In the nucleus of Li^6, 6 nucleons are arranged in two groups, two-neutrons and two-protons in group G and one-neutron and one-proton in group D, and the groups G and D are arranged as shown in Fig. 6(a). Group G possesses its linear velocity along +X direction, and the magnetic field around it occurs in YZ plane and in direction as shown by round arrow in its middle, Fig. 6(a). And group D possesses its linear velocity along -X direction, and the magnetic field around it occurs in YZ plane and in direction as shown by round arrow in its centre, Fig. 6(a).

The groups G and D, because of having their linear motions along +X and –X directions respectively, move towards each other, but due to Coulomb repulsive force between these (because of having charges +2e and +e by the groups G and D respectively), these stop moving forward towards each other after a certain distance, say d', is left between these.

Since the magnetic fields around the groups G and D occur in planes parallel to each other, their magnetic fields do not interact with each other and hence no binding force is generated between the groups G and D. Therefore, the binding energy per nucleon (E_b) for the nucleus of Li^6, i.e. $(E_b)_{Li^6}$, is obtained as follows:

$$(E_b)_{Li^6} = [\,E_t \text{ (i.e. total binding energy) of group } G + E_t \text{ of group } D\,]/6$$

$$= [4\times(E_b)_{He} + 2\times(E_b)_D]/6 \qquad \text{where } (E_b)_D \text{ is } E_b \text{ of deuteron}$$

$$\approx [4\times(E_b)_{He} + 2\times(E_b)_{He}/6]/6$$

Because according to expression (6), $(E_b)_\alpha > 6\,(E_b)_D$ and hence $(E_b)_D$ can be taken to be $\approx [\,(E_b)_{He}]/6$. Therefore the above expression reduces to

$$(E_b)_{Li^6} \approx 0.72\,(E_b)_{He} \quad \ldots\ldots \quad (8.1)$$

But against the repulsive Coulomb force between the groups G and D, since the groups G and D lose their some energy, E_t of groups G and D are reduced, and hence $(E_b)_{Li^6}$ is also reduced.

In the nucleus of Li^7, 7 nucleons are arranged in two groups, two-neutrons and two-protons in group G and two-neutrons and one-proton in group T_1, and the groups G and T_1 are arranged, as shown in Fig. 6(b). Group G possesses its linear velocity along +X direction, and the magnetic field around it occurs in Y Z plane and in direction shown by round arrow in its centre, Fig. 6(b). And group T_1 possesses its linear velocity along -X direction, and the magnetic field around it occurs in Y Z plane and in direction shown by round arrow in its centre, Fig. 6(b).

The groups G and T_1, because of having linear velocity along +X and –X directions respectively, move towards each other, but due to Coulomb repulsive force between these (because of having charges +2e and +e by the groups G and T_1 respectively), these stop moving forward towards each other after a certain distance, say d", is left between these.

Since the magnetic fields around the groups G and T_1 occur in planes parallel to each other, their magnetic fields do not interact with each other and hence no binding force is generated between the groups G and T_1. Therefore, the binding energy per nucleon (E_b) for the nucleus of Li^7, i.e. $(E_b)_{Li^7}$, is obtained as follows:

$(E_b)_{Li^7}$ = [E_t of group G + E_t of group T_1] /7

$= [4\times (E_b)_{He} + 3\times (E_b)_{T_1}]/7$ where $(E_b)_{T_1}$ is E_b of group T_1

$= [4\times (E_b)_{He} + 3\times 2.55\,(E_b)_D]/7$ because $(E_b)_{T_1} = 2.55^8\,(E_b)_D$

$\approx [4\times (E_b)_{He} + 3\times 2.55\,(E_b)_{He}/6]/7$ because $(E_b)_D \approx [(E_b)_{He}]/6$

$$\approx 0.75\,(E_b)_{He} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8.2)$$

But against the repulsive Coulomb force between the groups G and T_1, since the groups G and T_1 lose their some energy, E_t of groups G and T_1 are reduced, and hence $(E_b)_{Li^7}$ is also reduced.

From the expressions (8.1) and (8.2) we see, $(E_b)_{Li^7} > (E_b)_{Li^6}$, i.e. as A increases (i.e. from 6 to 7), E_b of nuclei increases, but $(E_b)_{Li^7}$ and $(E_b)_{Li^6}$ both are $< (E_b)_{He}$.

8.2 How nucleons are arranged in the nucleus of B^{11} such that its E_b is reduced to < E_b of Be^8 though A of B^{11} > A of Be^8

In the nucleus of B^{11}, 11 nucleons are arranged in three groups, two-neutrons and two-protons in group G_1, two-neutrons and two-protons in group G_2, and two-neutrons and on-proton in group T_1, and the groups G_1, G_2 and T_1 are arranged as shown in Fig. 6(c). The groups G_1 and G_2 possess their linear velocities along +X and –X directions respectively, and the magnetic fields around these occur in Y Z plane and in directions opposite to each other, shown by round arrows in their centers in Fig. 6(c). Group T_1 possesses its linear velocity along -Y direction, and the magnetic field around it occurs in X Z plane and in direction shown by round arrow in its centre, Fig. 6(c).

Since the magnetic field around group T_1 happens to be of triangular shape [see Fig. 3(g)], a little portion of magnetic field around group T_1, lying towards our left hand side, interacts with the magnetic field around group G_1. And similarly, a little portion of magnetic field around group T_1, lying towards our right hand side, interacts with the magnetic field around group G_2. And consequently, the left and right sides of group T_1 are loosely bound with the groups G_1 and G_2 respectively, and the groups G_1 and G_2 are loosely bound with each other through the group T_1.

Therefore, E_b for the nucleus of B^{11}, i.e. $(E_b)_{B^{11}}$, is obtained as follows:

$(E_b)_{B^{11}}$ = [(E_t of group G_1 + E_t of group G_2 + E_t of group T_1) + B.E. generated due to interaction between magnetic fields of groups G_1 & T_1 + B.E. generated due to interaction between magnetic fields of groups G_2 & T_1)] /11

= [(2× E_t of groups G + E_t of group T_1) + B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)] /11

$=$ $[2\times\{4\times(E_b)_{He}\}$ + $3\times(E_b)_{T_1}$ + B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)] /11

$\approx$ $[8\times(E_b)_{He}$ + $3\times2.55\,(E_b)_{He}/6$+ B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)] /11

$\approx$ $18.55\,(E_b)_{He}/22$ + [B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)] /11

$\approx$ $(E_b)_{He}$- $\{3.45\,(E_b)_{He}\}/22$ + [B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)] /11………. (8.3)

$<$ $(E_b)_{Be}$ ……………………………………………………………. (8.4)

Because in expression (8.3), the value of B.E. generated due to interaction between magnetic fields around (groups G_1 & T_1 + groups G_2 & T_1)/11 happens to be very small, and hence can never be $\geq$ $\{3.45\,(E_b)_{He}\}/22$.

8.3 How nucleons are arranged in the nucleus of N^{14} such that its E_b is reduced to < E_b of C^{12} though A of N^{14} > A of C^{12}

In the nucleus of N^{14}, 14 nucleons are arranged in four groups, two-neutrons and two-protons in each group G_1, G_2, G_3, and one-neutron and one-proton in group D, and all the four groups G_1, G_2, G_3, D are arranged as shown in Fig. 6(d). The groups G_1, G_2 and G_3 possess their linear velocities along +X, –X and -Y directions respectively, and the magnetic fields around the groups G_1, G_2 occur in Y Z plane and around group G_3 occurs in X Z plane. And the directions of magnetic fields around these occur as have been shown by round arrows in their centers in Fig. 6(d). Group D possesses its linear velocity along +Y direction, and the magnetic field around it occurs in X Z plane. The direction of magnetic field around it occurs as has been shown by round arrow in its centers in Fig. 6(d). Since the magnetic field around group D happens to be of rectangular or elliptical shape, Fig. 2(c), a little portion of magnetic field around group D, lying towards our left hand side, interacts with the magnetic field around group G_1. And similarly, a little portion of the magnetic field around group D, lying towards our right hand side, interacts with the magnetic field around group G_2. Hence, the groups G_1 and G_2 are bound with each other through the group D, but their binding happens to be loose.

The E_b for the nucleus of N^{14}, i.e. $(E_b)_{N^{14}}$, is obtained as follows:

$(E_b)_{N^{14}}$ = [(E_t of group G_1 + E_t of group G_2 + E_t of group G_3 + E_t of group D) + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) + B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D)] /14

= [3× E_t of groups G + E_t of group D + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) + B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D)] /14

= [3× {4× $(E_b)_{He}$ } + 2× $(E_b)_D$ + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) + B.E. generated due to interaction between magnetic fields of (groups G_1 & D + groups G_2 & D)] /14

$\approx$ [$12\times(E_b)_{He} + 2\times(E_b)_{He}$/ 6 + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) + B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D)] /14

$\approx$ $37(E_b)_{He}$/42 + [B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) + B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D)] /14

$\approx$ [$(E_b)_{He}$ + B.E. generated due to interaction between the magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)/12] – [$5(E_b)_{He}$/42 + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)/84] + [B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D] /14

$\approx$ $(E_b)_C$ – [$5(E_b)_{He}$/42 + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3)/84] + [B.E. generated due to interaction between magnetic fields around (groups G_1 & D + groups G_2 & D] /14 ………………………………………………………….. (8.5)

Because from expression (7.2), $(E_b)_{He}$ + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) /12 = $(E_b)_C$. Therefore,

$$(E_b)_{N^{14}} < (E_b)_C \quad \ldots\ldots \quad (8.6)$$

because in expression (8.5), the value of B.E. generated due to interaction between magnetic fields around (groups G_1 & D + of groups G_2 & D) /14 happens to be very small and hence can never be ≥ [$5(E_b)_{He}$/42 + B.E. generated due to interaction between magnetic fields around (groups G_1 & G_3 + groups G_2 & G_3) / 84].

9. EXPLANATION OF WHY AND HOW E_b OF NUCLEI, AFTER BECOMING MAXIMUM NEAR A = 62, GRADUALLY STARTS DECREASING AS A INCREASES, AND FOR A > 200, NUCLEI BECOME RADIOACTIVE AND α, β, γ AND ν START EMITTING FROM THESE, AND γ, ν OBTAIN PARTICLE LIKE EXISTANCE AND VERY HIGH ENERGY

9.1 Why and how E_b of nuclei, after becoming maximum near A = 62[8], gradually starts decreasing as A increases

In the nucleus, nucleons do not reside independently (except hydrogen, where one proton resides independently in the nucleus) but reside in the form of different types of groups G (having two-neutrons and two-protons, see Sec. 6), T_1 (having one-proton and two-neutrons, see Sec. 5.1), T_2 (having two-protons and one-neutron, see Sec. 5.3), and D (having one-proton and one-neutron, see Sec. 4.1). The nucleons are arranged in the form of above types of groups in nuclei of different mass number (A), as have been described, e.g., in Sects. 4, 5, 6, 7 and 8.

In a nucleus, when the nucleons are arranged in the form of above types of groups, among these, there act three types of forces: 1- The force which these possess due to having their linear velocity; 2- The force due to interaction between their magnetic fields which (magnetic fields) occur around these; 3- The Coulomb repulsive force due to having positive charge on these (+e on groups D and T_1, +2e on groups T_2 and G). The first two forces try to bring the groups close to each other while the third Coulomb repulsive force tries to oppose the first two forces. The first force remains always constant and does not depend on A, but the second and third forces go on increasing as A increases, because as A increases, the closeness among the groups increases. Therefore, E_b of the nucleus depends upon the resultant of second and third forces. Up to A = 24, the rate of increase in the magnitude of second force happens to be quite fast (see Sects. 7.1 to 7.6 and also Sec. 8). The rate of increase in the magnitude of third force happens to be comparatively negligible. Consequently E_b incases quite fast. Beyond A = 24 as A increases, the rate of increase in the magnitude of second force is reduced (see Sec. 7.7). The rate of increase in the magnitude of third force also probably now starts becoming gradually significant. Consequently, increase in E_b becomes slow. And beyond A = 48, as A increases, the rate of increase in the magnitude of second force is reduced further, and the rate of increase in the magnitude of third force probably now becomes significant. Consequently, near A = 62, E_b, after attaining its maximum value, starts gradually decreasing.

9.2 Why and how nuclei become radioactive when A > 200 and α, β, γ and ν start emitting from these

9.2.1 Why and how nuclei become radioactive when A > 200, and α and β particles start emitting

Beyond A is nearly = 62 as A increases, the closeness among the groups is probably increased as much that the third force gradually starts becoming more and more significant. Consequently E_b gradually starts decreasing and goes on decreasing continuously. When A

> 200, E_b is probably reduced as much that the bindings of the outer most groups with the joint group say G_R of the rest of all the other inner groups, start getting gradually loose.

Beyond Z is nearly = 45 as A increases, in nuclei, the percentage of N starts increasing in comparison to Z, and in heavy nuclei, it becomes nearly 50% higher than Z. It means, beyond Z is nearly = 45 as A increases, in nuclei, the percentage of groups T_1 starts increasing in comparison to the other groups (because in a group T_1, there occur two neutrons and one proton, see Sec. 5.1). Therefore, in heavy nuclei, among the outer groups, the percentage of groups T_1 happens to be higher in comparison to other groups.

In T_1 group, in its neutron structure since electrons are not strongly bound with their respective protons (see Sec.5.6), electrons may be separated from their respective protons. But both the electrons are not separated simultaneously from their respective protons because then T_1 group can never decay into group T_2 emitting a β particle (see Sec. 5.6). The electrons are separated one by one. If such an electron of a group, say T_1', is found in position as shown in Fig. 7(a), with another such electron of group, say T_1'', due to strong, short range and charge independent repulsive force generated between these (see Sec. 4.2, Ref. 7), both the electrons or one of these may be ejected from the nucleus depending upon which one is free such that it may be ejected. If ejection takes place, it results into emission of a β particle. If such an electron is found in position, as shown in Fig. 7(b), with a loosened G group, due to strong, short range and charge independent repulsive force generated between these (see Sec. 4.2, Ref. 7), both or one of these may be ejected from the nucleus depending upon which one is free such that it may be ejected. If electron is ejected from the nucleus, it results into β decay. If group G is ejected, it results into α decay. If electron and group G both are ejected from the nucleus, it results into α and β decay. (How β^+ and β^- decays take place, it shall be submitted for publication later on but shortly because it needs lot of discussion which is presently not possible and beyond the scope of the present paper too.)

The energy, which the emitted α and β particles possess, includes the energy the electron and group G had at the time when these were rejected, along with the energy these receive from the repulsive force. How the energy of the emitted β particles varies in a continuous energy spectrum form, see Sec. 3.7, Ref. 3.

The groups T_1, T_2, and D are not ejected (emitted) from the nuclei because: 1- In nuclei having A > 200, since the percentage of N becomes nearly 50% higher than Z, the possibility of occurrence of groups T_2 and D among the outer groups is probably reduced to zero, and hence their ejection (emission) from the nuclei is also reduced to zero; 2- Since the nucleons in the groups T_1, T_2, and D are not so strongly bound as are bound in group G, the groups T_1, T_2, and D do not behave like particles, and also, the magnetic fields around the groups T_1, T_2 are happened to be of triangular shape, Fig. 3(g), and around group D that happens to be of rectangular shape, Fig. 2(c), hence when any one of these groups is found in situation with an electron of neutron of group T_1, as group G is found, Fig. 7(b), due to interaction between their (electron and group T_1/group T_2/group D) magnetic fields, the repulsive force generated between these probably happens to be weak and not sufficient to eject group T_1/group T_2/group D from the nuclei.

9.2.2 Why and how γ and neutrino ν are emitted and these obtain their particle like existence

Currently, it is believed that when a nucleus emits α or/and β particle(s), the daughter nucleus is usually left in an excited state. It can then move to a lower energy state by emitting a γ photon in the same way as an atomic electron jumps to a lower energy state by emitting infrared, visible, or ultraviolet photons. But by such mechanism/method, neither the infrared, visible, ultraviolet photons are emitted nor can γ photons be emitted. Because, by such mechanism/method, the difference of energy between two states can never be emitted in the form of a bundle having particle like physical existence and such a high penetrating power. To collide with electrons in Compton's scattering, to eject electrons penetrating into metals in photoelectric effect etc. it is necessary that photons too must exist physically similarly as electrons exist physically [for detail, see Sec. 2.1.1(a), Ref. 6].

The bundles of radiation energy (i.e. photons) are emitted from orbiting electrons as the consequence of their expansions and sudden compressions. (For detail, see Sec. III B, Ref. 4, and for complete understanding about photons, see Sec. 2.2, Ref. 6. Secondly, protons shrink[11,12], and if protons shrink, the expansion and compression of electrons cannot be ruled out or denied.). Similarly γ photons too are emitted but from the free electrons as the consequence of their collisions with protons. Because when the electrons of neutrons of groups T_1 are separated from their respective protons, if these are ejected from the nucleus, β decays take place (see Sec. 9.2.1), and if not ejected from the nucleus, these collide back with their respective protons. When these collide, these suffer sudden jerk that produces almost the same effect as the compression produces but with much strength. Consequently, a bundle of radiation energy is emitted from each of the colliding electrons. The bundles of radiation energy thus obtained are the γ photons we observe emitting during the nuclear decays. Further, when electrons collide with their respective protons, since the protons too suffer jerk, a bundle of energy is emitted from each of the colliding protons. These bundles are the neutrinos.

9.2.3 Why and how γ and ν obtain so high energy and momentum

After collision with proton, say with proton P_1 of neutron N_1, when the velocity of electron E_1 is reduced to zero, a bundle of radiation energy is emitted from the electron E_1 in the form of a γ particle and the difference, "M.E. of electron E_1 before its collision - M.E. of electron E_1 after its collision – radiation energy contained in γ photon", is imparted to γ photon as its M.E. in order to conserve M.E. of electron E_1. The difference, "M.M. of electron E_1 before its collision - M.M. of electron E_1 after its collision", is imparted to γ photon as its M.M. in order to conserve M.M. of electron E_1. And the difference, "L_s (resultant spin angular momentum = $\boldsymbol{L_{sc}} \pm \boldsymbol{L_{sm}}$) of electron E_1 before its collision - L_s of electron E_1 after its collision", is imparted to γ photon as it's L_s in order to conserve L_s of electron E_1.

Similarly, after collision with electron E_1 when the velocity of proton P_1 is reduced, a bundle of energy is emitted from proton P_1 in the form of a neutrino (ν) and the difference, "M.E. of proton P_1 before its collision - M.E. of proton P_1 after its collision – energy contained in ν", is imparted to ν as its M.E. in order to conserve M.E. of proton P_1. The difference, "M.M. of proton P_1 before its collision - M.M. of proton P_1 after its collision", is imparted to ν as its M.M. in order to conserve M.M. of proton P_1. And the difference, "L_s (resultant spin angular momentum = $\boldsymbol{L_{sc}} \pm \boldsymbol{L_{sm}}$) of proton P_1 before its collision - L_s of proton P_1 after its collision", is imparted to ν as it's L_s in order to conserve L_s of proton P_1.

After collision, e.g. of electron E_1 with proton P_1, since the velocity of electron E_1 is reduced to zero, the difference in its M.E. and in M.M. between its two states (before collision and after collision) are happened to be quite large, M.E. and M.M. of the emitted γ photon from electron E_1 too are happened to be quite large. Consequently, γ photons possess very high penetrating power.

The difference in M.E. and in M.M. between two states of proton P_1 too are happened to be quite large, and consequently M.E. and M.M. of the emitted ν from proton P_1 are happened to be quite large.

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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: Fig. 4: In the structure of a deuteron: (a) arrangement of one-neutron and one-proton each having linear velocity v; (b) interaction between the magnetic fields of nucleons; (c) shape of the outer portion of the magnetic field obtained around the deuteron.

Fig. 3: In the structure of a nucleus of H^3: (a) arrangement of two-neutrons and one-proton each having linear velocity v; (b) formation of two deuterons D_1, D_2; (c) interaction between magnetic fields of nucleons. In the structure of a nucleus of He^3: (d) arrangement of one-neutron and two-protons each having linear velocity v; (e) formation of two deuterons D_1, D_2; (f) interaction between magnetic fields of nucleons. (g) Shape of the outer portion of the magnetic field obtained around the nuclei of H^3 and He^3, and the direction of linear velocity v obtained by them. (h, i) Arrangement of three-neutrons and one-proton, each neutron and proton is having linear velocity v, in a nucleus of synthesized isotope H^4. (j, k) Arrangement of one-neutron and three-protons, each proton and neutron is having linear velocity v in a nucleus of isotope Li^4.

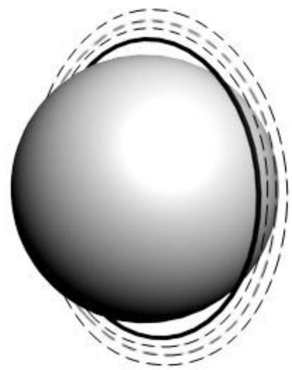
Fig. 4: In the structure of an alpha particle (or a group G): (a) arrangement of two-neutrons and two-protons each having linear velocity v; (b) formation of four deuterons D_1, D_2, D_3, D_4; (c) formation of two T_1 groups, (d) formation of two T_2 groups; (e) interaction between

magnetic fields of nucleons; (f) shape of the outer portion of the magnetic field obtained around alpha particle (or group G) and the direction of linear velocity v obtained by it.

Fig. 5: Arrangement of nucleons in a nucleus: (a) of He^4, (b) of Be^8, (c) of C^{12}, (d) of O^{16}, (e) of Ne^{20}, and (f) of Mg^{24}.

Fig. 6: Arrangement of nucleons in a nucleus: (a) of Li^6, (b) of Li^7, (c) of B^{11}, (d) of N^{14}.

Fig.7: (a) Transverse cross sectional view of interaction between magnetic fields of electrons E and E' at the instant when they are in the same plane at distance d apart from each other and the directions of their motion are parallel to each other but opposite in directions. (b) Transverse cross sectional view of interaction between magnetic fields of electron and α particle at the instant when they are in the same plane at distance d' apart from each other and the directions of their motion are parallel to each other but opposite in directions..



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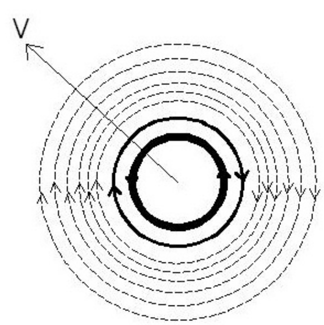

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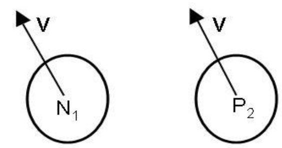
Fig. 1



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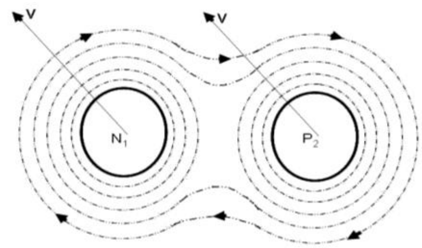

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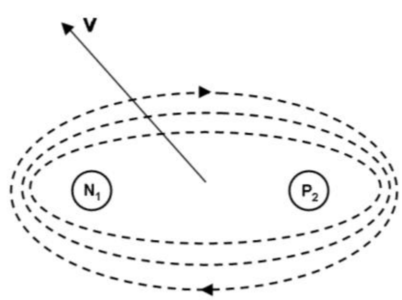

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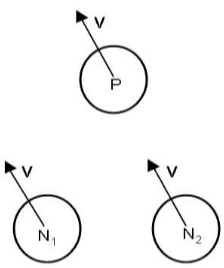
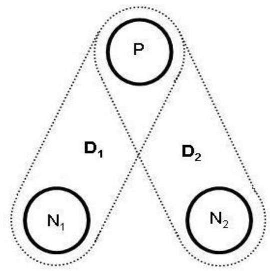
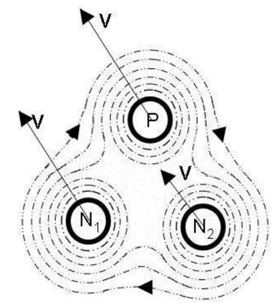
Fig. 2


v
P
v
N1
v
N2

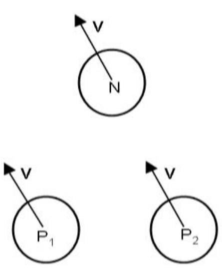
(a)


P
D1
D2
N1
N2

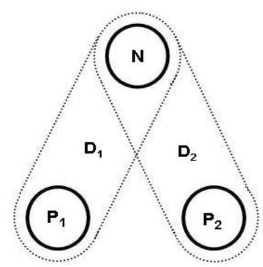
(b)


v
P
v
v
N1
N2

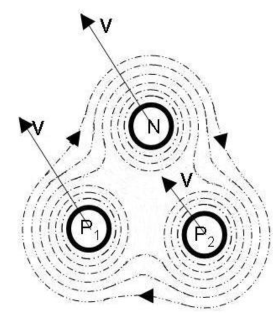
(c)


v
N
v
P1
v
P2

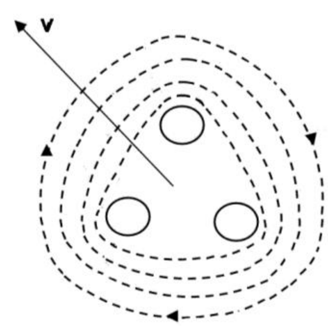
(d)


N
D1
D2
P1
P2

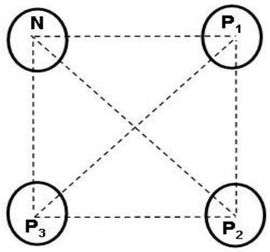
(e)


v
N
v
v
P1
P2

(f)


v

(g)



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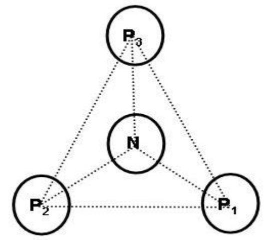

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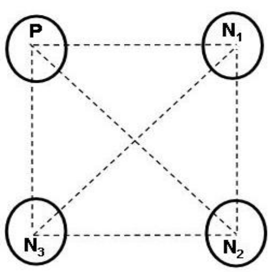

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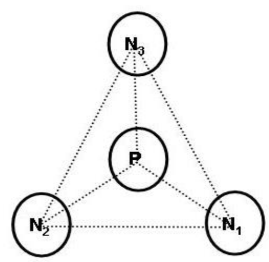

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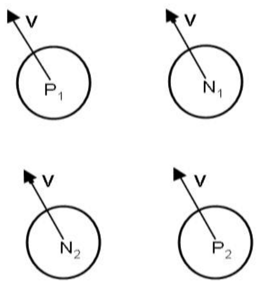
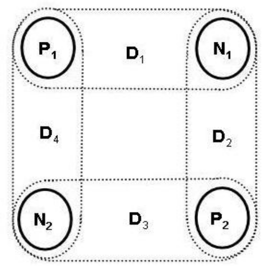
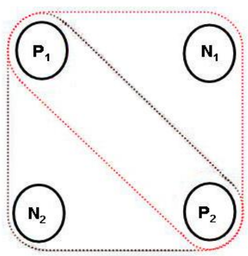

v
v
P1
N1
v
v
N2
P2

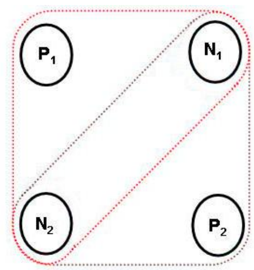
(a)


P1
D1
N1
D4
D2
N2
D3
P2

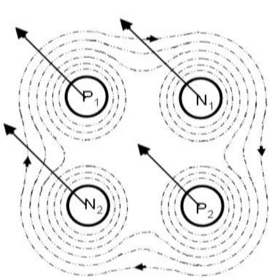
(b)


P1
N1
N2
P2

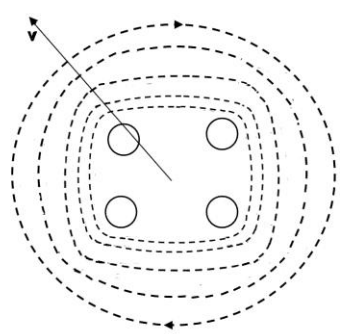
(c)


P1
N1
N2
P2

(d)


P1
N1
N2
P2

(e)


v

(f)

Fig. 4

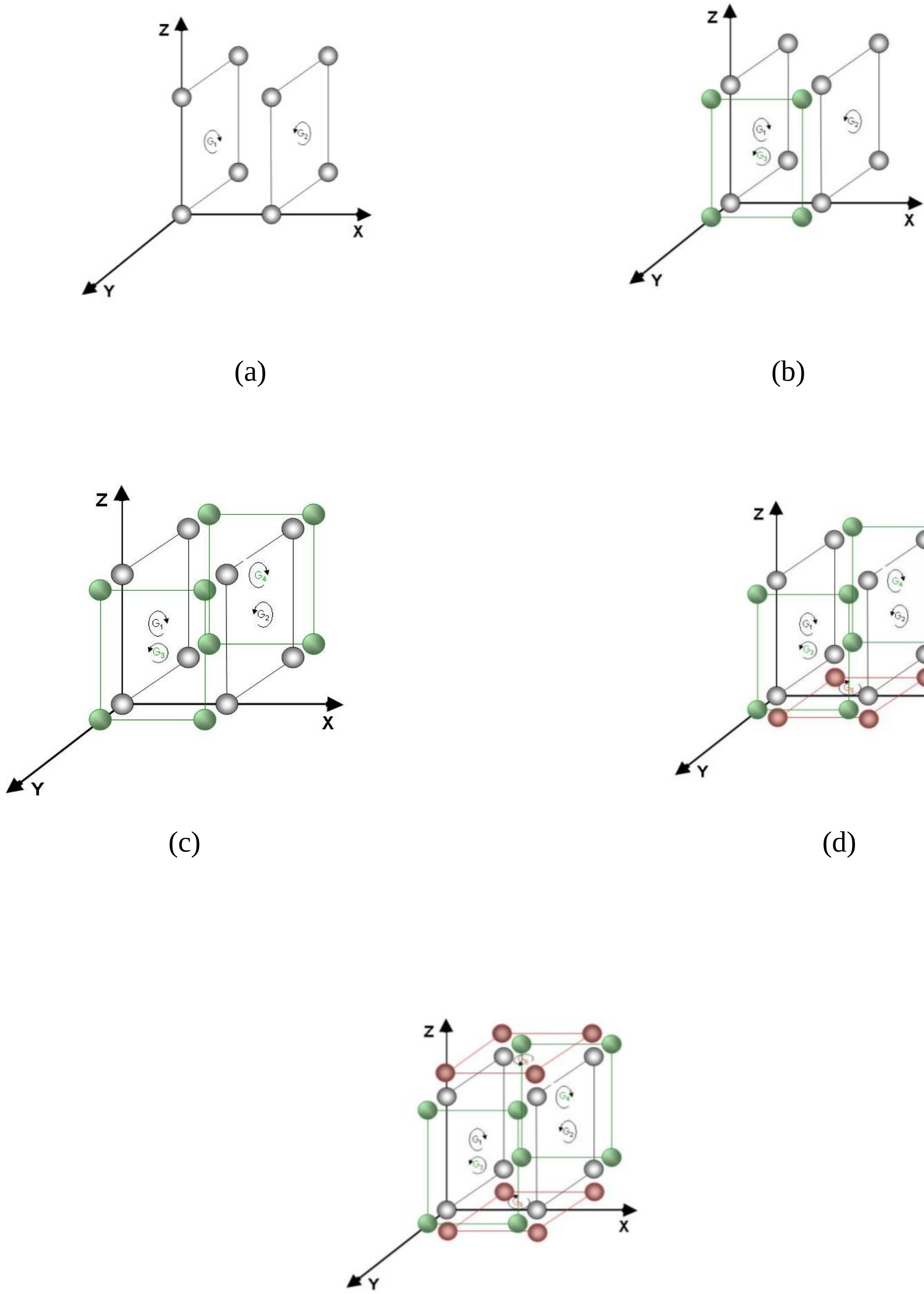
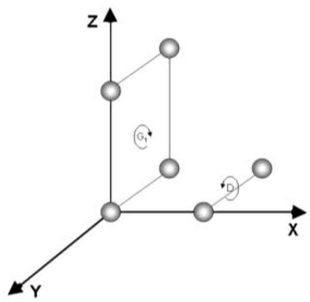


Fig. 5



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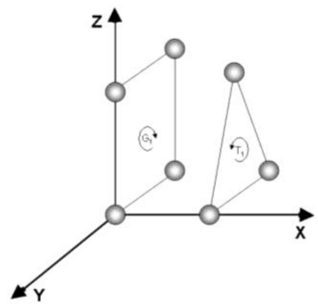

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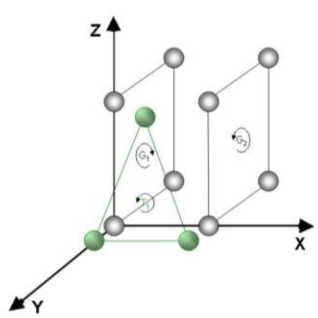

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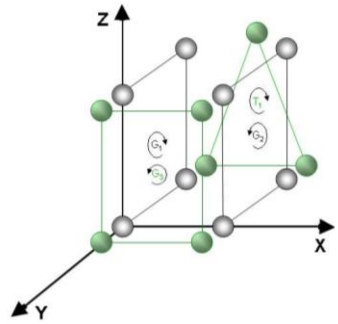

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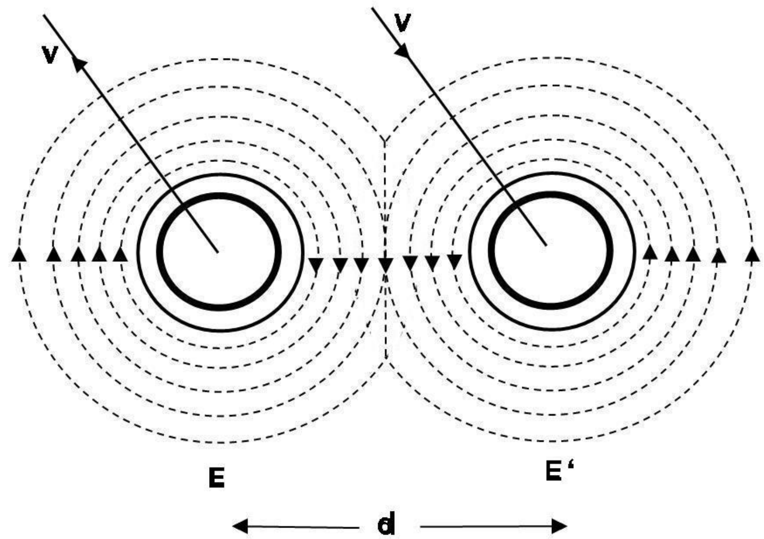
Fig. 6



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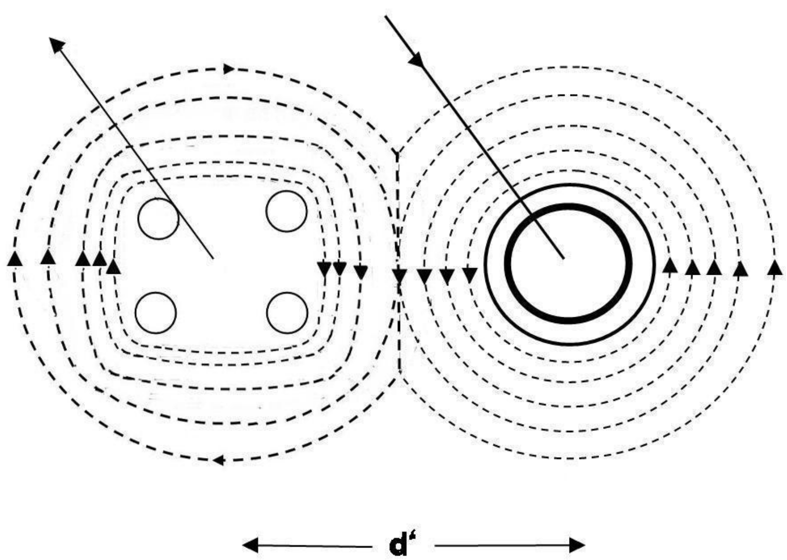

(b)

Fig. 7