EXMF-PS

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THE UNIVERSAL ENERGIES

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ABSTRACT

Natural energization of electrons and protons is accomplished with and through the production of external magnetic field (***ExMF***), whenever these particles interacted with moving or rotating magnetic lines of force. With abundant charged particles, the continuation of both mechanisms could lead to proton and electron's fusion as consequential resultant of produced intense ***ExMF***. This paper investigates some crucial main relations and sequence of the three mechanisms based on the magnetic interaction hypothesis (***MIH***), thus proposing new methods for energies transformations, that could benefit humanity.

1: INTRODUCTION

Sunspots are important signs for the start of solar activities; they are interpreted as the cooler areas on the sun surface [1]. It's formed by intense magnetic fields that have enormous number of magnetic lines of force [2]. Evidence of sunspots sticking out from the sun by curved magnetic field had been found [3]. Its appearance is linked with the start of the solar flare [2], hence ignition of intense geomagnetic storms on earth [4] leading to different phenomena such as the aurora [5]. Solar flares are known to erupt in Galaxies and stars [2], such as the SGR 1900+14, a neutron star about 45,000 light years away [3] that produced magnetic fields of $8x10^{10}$ Tesla [6].

The geomagnetic storms started when solar ejected flare's protons and electrons processed and re-energized to various energies in specific regions, such at the bow shock [7], with existence of abnormal high magnetic fields (these fields are referred to here as external magnetic field or ***ExMF***, since it is produced outside atom. The interaction regions producing ***ExMF***, existed near 1 AU, it also existed between 1 and 5 AU, and deep in the geomagnetic tail [8, 9], and it's always accompanied with a shock fronts [10]. Anomalous magnetic fields that accompanied shock waves were interpreted as interplanetary magnetic field (IMF), the detection of ***ExMF*** at 13.18 Re [11] formed the bases behind IMF, which was interpreted as been produced by the motion of the plasma [12] or that it is dragged from the sun by the plasma [13] then settled on the later [14], although multiple ***ExMF*** several times in magnitudes had been detected between 17-27 R_e in the neutral sheet of magnetotail [14, 8,15] hence, can ***ExMF*** (or IMF) in the magnetotail perform the Archimedean spiral, or any rotation while shaded from the sun by the magnetosphere?

The low energy interplanetary particles are energized in the bow shock [7, 16] then transferred into the magnetosphere through the magnetosheath [17].

These energized particles forms the ring current [14], Van Allan radiation belt [18,19], and the stable aurora red arcs [20], while aurora oval [21] particles are thought to be attained in a different mechanism.

Although the idea of producing intense magnetic field outside atom, with ability of changing atom's characteristics was mentioned by Kapitza [22], and had been suggested as a possible propellant for UFOs [23] but the separation of IMF (or ***ExMF***) from earthly surface magnetic

disturbances [13] brought about theories such as the electric current in the outer layer of the magnetosphere [24], all of which lead to the present confused situations

This paper investigates some crucial main relations and sequence of these three related mechanisms, based on the ***MIH*** [25], Spinning Magnetic Force (***SMFs***) [26] and Element of Magnetic Lines of Force (***EMLF***) [27]. These mechanisms are based on energization of charged particles on macro-scales that enable it producing ***ExMF***, hence after a sequence of intense ***ExMF*** build up, that could lead to the fusion of the gyrating particles.

Therefore, the 11¼ years cycle that leads to the formation of intense sunspots [1] is thought of as a timely energization process of charged particles in large scale, while gyrating around magnetic lines of force, synchronized with production of intense ***ExMF*** leading to the fusion of charged particles at final stage, thus resulting in the solar flares.

These mechanisms represent the universal energies production or transformations in the Galaxies, stars, comets and some planets. It also represents energization of charged particles to various spectrums that produce aurora and other phenomena in our planet and Jupiter; therefore, it may turn to be an important method for energy transformation that may help enriching continuation of humanity cycle.

2: ENERGIZATION OF CHARGED PARTICLES PHASE-I

2.1 MICRO-ENERGIZATION OF CHARGED PARTICLES

On micro-scales, energization of charged particles by a moving or rotating magnetic line of force [25] gives the kinetic energy K express as

$$K = B_1 B_2 r_m^2 c d \sin\theta \quad J \qquad \{1\}$$

Where, B_1 is the rotating magnetic field (movement of geomagnetic field or the comets around the sun, while geomagnetic field also rotate daily with the earth) in Tesla, B_2 is the circular magnetic field in Tesla (CMF) produced by the charged particle, r_m is the magnetic radius in meter, d is the distance moved or rotate by the magnetic field B_1 in meter, θ is the angle between the two fields during the capturing process, q is the elementary charge in Coulomb, v_c is the velocity of charged particle when captured and the kinetic energy K is in joules (J). Thus Eq.{1} represents the bases for further building block.

3: EXTERNAL MAGNETIC FIELD (ExMF)

3.1 MICRO PRODUCTION of External Magnetic Field (ExMF)

As shown in Fig.1, micro production of ***ExMF*** represents the imposition the production of circular magnetic field (***CMF or B_2***) by electrons and protons [25], oppositely to the magnetic line of force of field B_1, Hence

$$B_E = B_1 + B_2 = B_1 + \frac{q\, v_c}{r_m^2\, c} = B_1 + \frac{q^3\, B_1^2}{m_{e/p}^2\, v_c\, c} \quad T \qquad \{2\}$$

Where, $m_{e/p}$ electron or proton's mass in kg.

The micro production of External magnetic Field (***ExMF***) by electron in Fig.1, (***A***) and proton in (***B***), resulted from interaction of both particle's circular magnetic field (***CMF***) with magnetic line of force (***B_1***) [25]. Shown also, is the relative Orbit, circular magnetic field (***CMF***) and ***ExMF*** dimension and magnitudes.

3.2 PRODUCTION of INTENSE ExMF PHASE-ONE

If number of electrons or protons interacted with moving or rotating magnetic lines of force along one meter is denoted by (n_m), it have field intensity (B_1), therefore produced ***ExMF*** shown in Fig.2, is given by

$$B_E = (B_1 + n_m \, l \, B_2) = B_1 + n_m \, l \, \frac{q^3 \, B_1^2}{m_{e/p}^2 \, v_c \, c} \quad T \qquad \{3\}$$

Where, l is the effective length of the magnetic lines of force around which charged particles are gyrating.

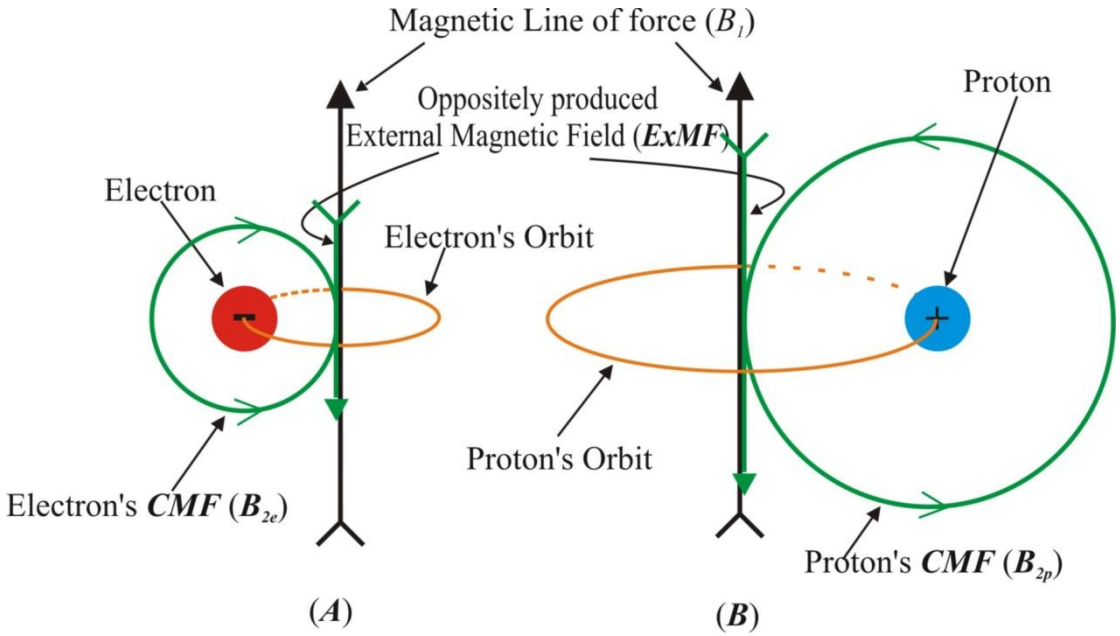

Fig. 1. Micro production of External magnetic Field (***ExMF***) by an electron in (*A*) and proton in (*B*), resulted from interaction of both particle's circular magnetic field (***CMF***) with magnetic line of force (B_l) [25]. Shown also, is the relative Orbit, circular magnetic field (***CMF***) and ***ExMF*** dimension and magnitudes.

3:3 VERTICLE MAGNETIC FORCES

In the system above, a vertical magnetic force produced from adjacent CMF_2 [25] attracts adjacent orbital electrons or protons towards each other, along the guiding centre as shown in Fig.{2}, the force is given by

$$F_{mV} = B_{V1} \, B_{V2} \, r_{mV1} \, r_{mV2} \, c \quad N \qquad \{4\}$$

Where, B_{V1} and B_{V2} are magnitudes of two tangents CMF_2 (B_{V1}) in adjacent orbits, r_{mv1} and r_{mv2} are radius of each CMF_2 (B_{V2}), c is the speed of light in ms^{-1} and the vertical magnetic force (F_{mV}) or orbital lock force is in Newton.

As shown in Fig.2, When r_{mV} decreased, B_{V1} and B_{V2} becomes part of B_{EI} Eq.{4}, becomes

$$F_{mV} = B_{EI1} \, B_{EI2} \, r_{mV1} \, r_{mV2} \, c \quad N \qquad \{5\}$$

3:4 PRIMARY AND SECONDARY ExMF

Figs.2 & 3, shows the primary ***ExMF*** (***P-ExMF***) produced around magnetic lines of force of B_1 and given by Eq. {3}. Secondary ***ExMF*** (***S-ExMF***) shown in Fig.2, is a combination of ***CMF*** produced at peripheries having larger radius, therefore both fields participated in producing ***ExMF*** by the following

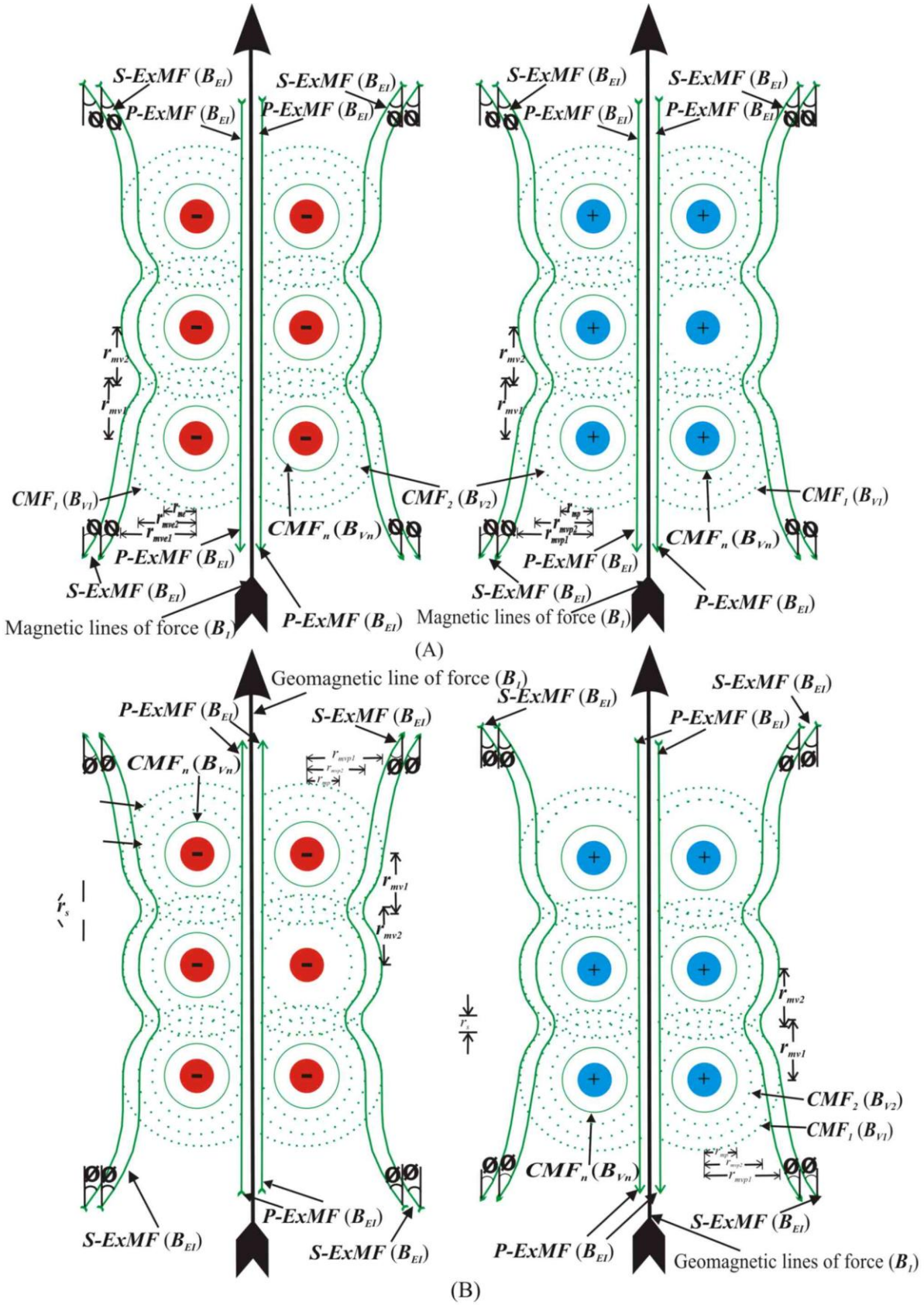

Fig.2. Cross-section along Magnetic lines of force ($\boldsymbol{B_1}$) showing solar wind interaction with northern-geomagnetic field at 14.6 Re, field in (***A***) and Southern-geomagnetic field in (***B***), producing both primary and secondary external magnetic field (***P-ExMF*** and ***S-ExMF***), forming the shock front. Angle Ø is formed between ***S-ExMF***, and the line parallel to ***P-ExMF*** or $\boldsymbol{B_{EI}}$ (the line extended from earth to Sun). The mechanism also constitutes the bases for ExMF production to attain fusion.

$$\gamma_m = \frac{2\, r_m}{r_m + \ 0.5\, r_s} \qquad \{6\}$$

Where, r_s is the distance between two ***CMF*** as shown in Fig.2, and γ_{PS} is the relative magnitudes of both ***P & S-ExMF*** in production of ***ExMF***.
Substituting the gyrating radius r_m = mv/qB, in the above, the following is obtained

$$\gamma_{ps} = \frac{2\, m\, v}{m_{e/p}\, v + \ 0.5\, q\, B\, r_s} \qquad \{7\}$$

The ***S-ExMF*** or $\boldsymbol{B_S}$ is given by

$$B_s = \frac{\gamma_{PS}\, B_{EI}}{10} \quad T \qquad \{8\}$$

3:5 PRODUCTIONS OF INTENSE ExMF-PHASE-TWO

Since number of magnetic lines of force is related to magnetic field intensity ($\boldsymbol{B_1}$), [28], and it is equivalent to B_1 x 10^8 [27], therefore intense ***ExMF*** ($\boldsymbol{B_{EI}}$) produced in square meter, having both ***P*** & ***S-ExMF*** is given by

$$B_{EI} = 10^8 \gamma_{PS} B_P (B_P + n_m l\, B_2) = 10^8 \gamma_{PS} B_P \left(B_P + n_m l\, \frac{q^3\, B_P^2}{m_{e/p}^2\, v_c\, c} \right) \quad T \qquad \{9\}$$

Where, B_P is the previous field intensity. From Eq.{8} the following is obtained

$$B_{EI} = 10^8 \gamma_{PS} B_P + (10^8 \times n_m l B_P B_2) = 10^8 \left(\gamma_{PS} B_P^2 + \frac{\gamma_{PS} n_m l q^3\, B_P^3}{m_{e/p}^2\, v_c\, c} \right) \quad T \qquad \{10\}$$

l
From Eq{10}, number of charged particles producing specific B_{EI} is given by

$$n_m = \frac{m_{e/p}^2\, v_c\, c}{l q^3 B_P^3} \left(\frac{B_{EI}}{10^8 \gamma_{PS}} - \ B_P^2 \right) \qquad \{11\}$$

The effects of the ***ExMF*** ($\boldsymbol{B_{EI}}$) is to reduce radius of gyration, therefore by substituting the right hand part of Eq.{10} in the equivalent of centripetal with magnetic force, the magnetic radius is obtained

$$r_{mE} = \frac{n_o m_{e/p} v_c}{10^8 \gamma_{PS}\, q (B_P^2 + \frac{n_m l q^3 B_P^3}{m_{e/p}^2 v_c\, c})} \quad m \qquad \{12\}$$

Where, n_o is number of gyrating charged particles in each orbit.

4: ENERGIZATION OF CHARGED PARTICLES PHASE-II

4.1 MACRO-ENERGIZATION OF CHARGED PARTICLES

Since the magnetic field $\boldsymbol{B_1}$ in Eq.{1} increased to $\boldsymbol{B_{EI}}$ given by Eq.{10}, thus decreasing the gyrating radius given by Eq.{12}, hence energization becomes

$$K = B_{EI}\, B_2\, r_{mE}^2\, c\, d\, sin\,\theta\ = qB_{EI}v_c\, sin\,\theta \quad J \qquad \{13\}$$

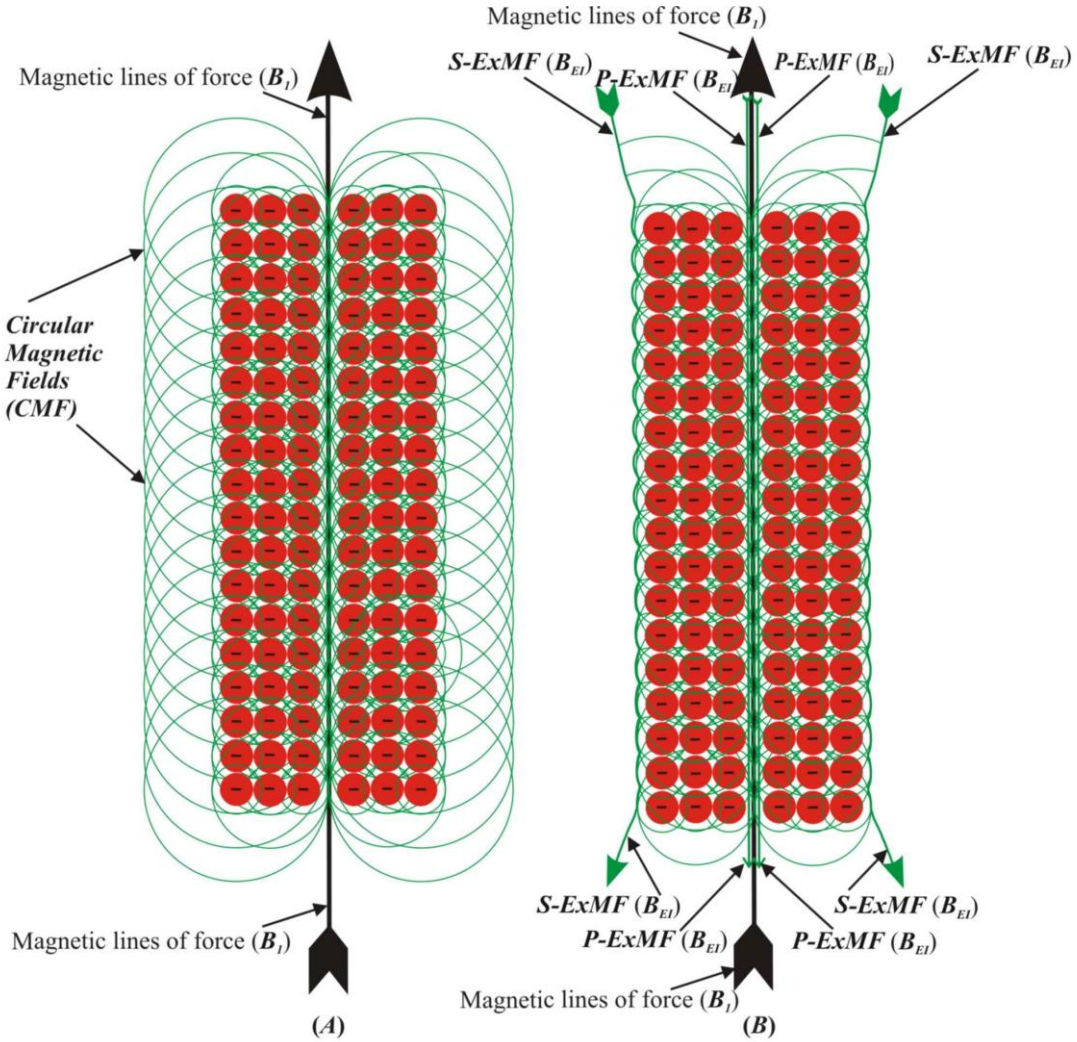

Fig.3. Electrons gyrating around magnetic line of force (B_I) producing intense circular magnetic fields (***CMFs***), as shown in (***A***). Attached to B_I, each ***CMF*** added to B_I, constituting primary external magnetic field (***P-ExMF***), while peripheries ***CMF*** constitutes secondary ***ExMF*** (***S-ExMF***), resulted ***ExMF*** is shown in (***B***). Figs.4&5, shows cross section of maximum produced ***ExMF*** as in (***B***) above, igniting fusion mechanism.

Substituting B_{EI} given by the right part of Eq.{10} in the right hand part of Eq.{13}, energization of charged particles resulted from produced intense ***ExMF*** is given by

$$K = 10^8 \left(d\gamma_{PS}\, q\, v_c B_P^2 + \frac{d\, \gamma_{PS}\, n_m\, l\, q^4\, B_P^3}{m_{e/p}^2\, c} \right) sin\theta \quad J \qquad \{14\}$$

To include the K general at each step, we attach a subscript (i) to K so that K_i represents the energy given at step i hence

$$K_i = 10^8 \left(d\gamma_{PS}\, q\, v_c B_P^2 + \frac{d\, \gamma_{PS}\, n_m\, l\, q^4\, B_P^3}{m_{e/p}^2\, c} \right) sin\theta\,|_i \quad J \qquad \{15\}$$

Where the symbol $|_i$ indicates the value of K_i at the i step

Alternatively we may introduce a dummy variable δ_i that allow us to measure the change in energy in a given period of length *l* in such a manner its accessible to obtain an approximate reading during this arbitrary period, hence, K_i can be approximate as:

$$K_i = 10^8\ \delta_i \left(d\gamma_{PS}\ q\ v_c B_P^2 + \frac{d\ \gamma_{PS}\ n_m\ l\ q^4\ B_P^3}{m_{e/p}^2\ c} \right) sin\theta \quad J \qquad \{16\}$$

At the *i* step (*i* = 1, 2, …..n). Where $\delta_i = 1$ when B >9 nT, and $\delta_i = 0$ when B = 0. If B_{EI} in Eq{13} continuously increasing, then energy built up gained by charged particles may be approximately computed as measured

$$K_T = K_1 + K_2 + K_3\ \ldots\ldots\ldots + K_n + \varepsilon \quad J \qquad \{17\}$$

Where, K_1, K_2 … K_n are energization executed, $\varepsilon = \varepsilon_i$ where ε_i is the error of continuity approximation at step *i*, K_T is the total approximate energy acquired or gained by the charged particle in Joules. The new radius r_{mE} is given by

$$r_{mE}\ \sqrt{\frac{K}{B_{EI}\ B_2\ c\ d\ sin\theta}} = \frac{m_{e/p} v_c}{q B_{EI}} = \left(\frac{m_{e/p}\ v_c}{10^8\ \gamma_{PS}\ (q B_P^2 + n_m l\ \frac{q^4 B_P^3}{m_{e/p}^2 v_c\ c})} \right) m \qquad \{18\}$$

The following are two examples showing spectrum product of energization process.

Mag. Field & ***ExMF*** **n T**		Radius **m**		Force x10^{-22} **N**		Protons x10^5		***P-ExMF*** & ***S-ExMF***		Energy **eV** θ=75°	
										K	+ 856.18 **Capt.Energ.**
$\mathbf{B_1}$	11.0	$\mathbf{r_m}$	379625.0	$\mathbf{F_m}$	6.58 θ=75°	$\mathbf{n_1}$	0.5	γ_1	1.05	$\mathbf{K_1}$	+179.50 **1st Energ.** =***1035.68*** sub-total
$\mathbf{B_{EI1}}$	12.70	$\mathbf{r_{ME1}}$	328809.06	$\mathbf{F_{m1}}$	7.86	$\mathbf{n_2}$	0.96	γ_2	1.10	$\mathbf{K_2}$	+259.52 **2nd Energ.** =***1295.2*** sub-total
$\mathbf{B_{EI2}}$	17.74	$\mathbf{r_{mE2}}$	325393.18	$\mathbf{F_{m2}}$	10.98	$\mathbf{n_3}$	1.42	γ_3	1.15	$\mathbf{K_3}$	+529.40 **3rd Energ** =***1824.60*** sub-total
$\mathbf{B_{EI3}}$	36.19	$\mathbf{r_{mE3}}$	115387.54	$\mathbf{F_{m3}}$	23.19	$\mathbf{n_4}$	1.88	γ_4	1.20	$\mathbf{K_4}$	+2298.98 **4thEnerg.** = ***4122.58*** sub-total
$\mathbf{B_{EI4}}$	157.16	$\mathbf{r_{mE4}}$	26570.85	$\mathbf{F_{m4}}$	100.72	$\mathbf{n_5}$	2.34	γ_5	1.25	$\mathbf{K_5}$	+45161.7 **5th Energ.** =***49284.35*** Total
The following step could occur at specific conditions											
$\mathbf{B_{EI5}}$	3210.90	$\mathbf{r_{mE5}}$	1300.53	$\mathbf{F_{m5}}$	2057.77	$\mathbf{n_6}$	2.8	γ_6	1.30	$\mathbf{K_6}$	+19.6MeV**6thEnerg.** =***19.65*** **MeV T. Ene.**

Table.1. Interaction of Protons solar wind (400kms^{-1}) with geomagnetic field at 14.615 Re near down (θ=75^o) resulted in ***ExMF*** (or IMF) production (see Fig.2), and related different protons energization levels. K_6 shows sub-Cosmic rays possibilities.

Mag. Field & ***ExMF*** n **T**		Radius **m**		Force x10^{-22} **N**		Electrons x10^5		***P-ExMF*** & ***S-ExMF***		Energy **e**V θ=75^o	
										K	+ 0.45 **Capt. Energ.**
$\mathbf{B_1}$	11.0	$\mathbf{r_m}$	206.75	$\mathbf{F_m}$	6.81 θ=75^o	$\mathbf{n_1}$	0.5	γ_1	1.05	$\mathbf{K_1}$	+179.96 **1st Energ.** =***179.96*** sub-level
$\mathbf{B_{EI1}}$	12.7	$\mathbf{r_{ME1}}$	179.07	$\mathbf{F_{m1}}$	8.14	$\mathbf{n_2}$	0.96	γ_2	1.10	$\mathbf{K_2}$	+250.592**nd Energ.** =***430.55*** sub-level
$\mathbf{B_{EI2}}$	17.74	$\mathbf{r_{mE2}}$	128.2	$\mathbf{F_{m2}}$	11.37	$\mathbf{n_3}$	1.42	γ_3	1.15	$\mathbf{K_3}$	+**511.363rd Energ** =***941.91*** sub-level
$\mathbf{B_{EI3}}$	36.19	$\mathbf{r_{mE3}}$	62.84	$\mathbf{F_{m3}}$	23.19	$\mathbf{n_4}$	1.88	γ_4	1.20	$\mathbf{K_4}$	+**2220.654thEnerg.** =***3162.56*** sub-level
$\mathbf{B_{EI4}}$	157.17	$\mathbf{r_{mE4}}$	14.47	$\mathbf{F_{m4}}$	100.72	$\mathbf{n_5}$	2.34	γ_5	1.25	$\mathbf{K_5}$	+**43629.315thEnerg.** =***46781.87*** Total
The following step could occur at specific conditions											
$\mathbf{B_{EI5}}$	3087.86	$\mathbf{r_{mE5}}$	0.74	$\mathbf{F_{m5}}$	1978.92	$\mathbf{N_6}$	2.8	γ_6	1.3	$\mathbf{K_6}$	17.52MeV**6thEnerg.** =***17.56*** **Me VT.Ene.**

Table.2. Interaction of electron's solar wind (400 kms^{-1}) with geomagnetic field at 14.615 Re near down (θ=75^o) resulted in ***ExMF*** (or IMF) production (see Fig.2), and related different energization values. K_6 shows very high energy production.

5 MAXIMUM REPRODUCTION OF ExMF

5:1 VOLUME OF MAGNETIC LINES OF FORCE

In a system such as Fig.4, where captured charged particles are abundant and energization given by Eq.{16} is continual, orbital charged particles are denoted by n_o, orbits number in one meter along the lines of force is denoted by O_n, therefore the total number of gyrating charged particles in volume of magnetic lines of force [27] is given by

$$N_V = 10^8\, n_o\, O_n\, l\, B_1 \qquad \{19\}$$

Where, N_V is the number of charged particles gyrating in specific volume of magnetic lines of force.

5:2 THE ELECTRONS FUSION

As shown in Fig.4, intense $\boldsymbol{B_{EI}}$ given by Eq.{10}cause decrease in radius of gyration, given by Eqs.{12 and 18}, hence the circumference, and adjacent distances ($\boldsymbol{r_r}$) between orbital electrons shown in Fig.2.a, reduced from (a) to (c), therefore production of ***ExMF*** is at its maximum; thus substituting Eq.{19} with n_m in Eq.{10}, hence

$$B_{EE} = 10^8 \left(\gamma_{PS}\, B_P^2 + \frac{\gamma_{PS}\, n_o\, O_n\, l\, q^3\, B_P^3}{m_e^2\, v_c\, c} \right) \quad T \qquad \{20\}$$

Where, $\boldsymbol{B_{EE}}$ is maximum ***ExMF*** produced by electrons.

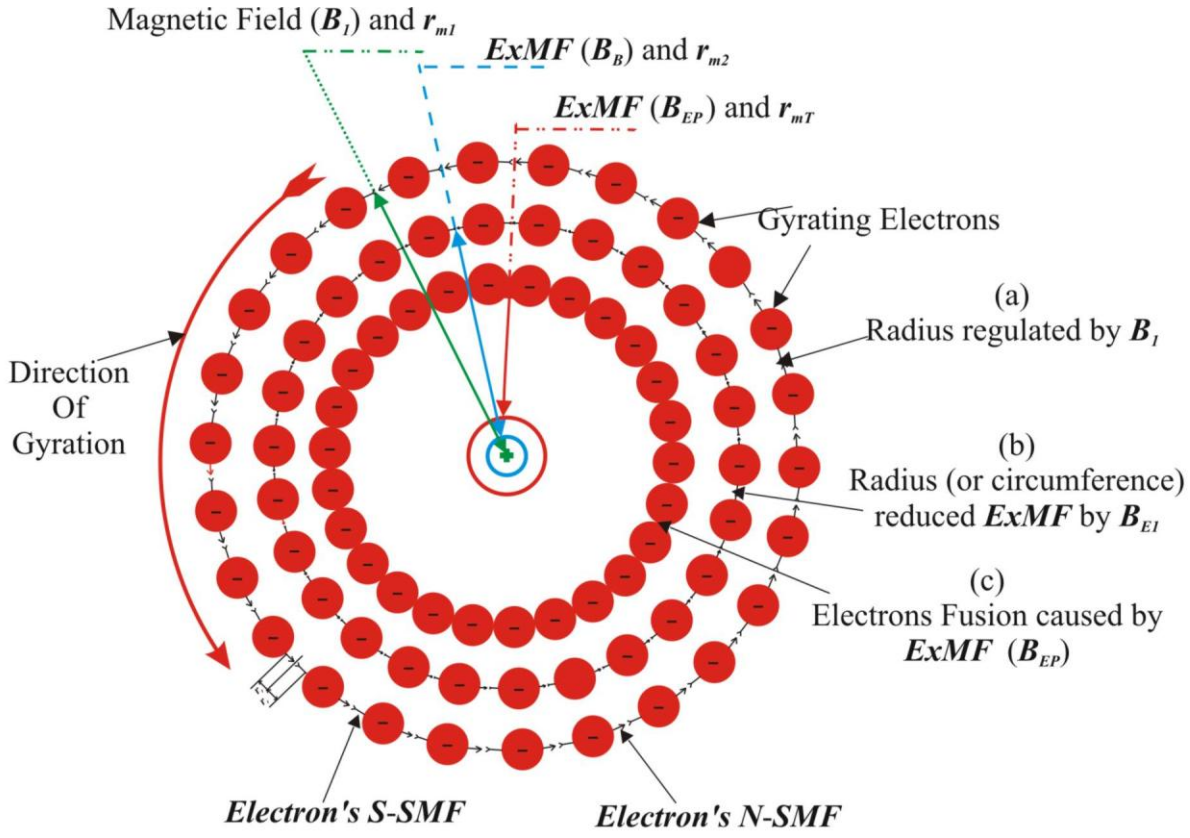

Fig.4. Cross-section of orbital gyrating electrons showed in Figs.2 and 3. The produced external magnetic fields (***ExMF***) given by $\boldsymbol{B_{EI}}$ to $\boldsymbol{B_{EE}}$ reduced the radius of gyration, orbital circumference, hence the distance between adjacent north (***N***) and south (***S***) Spinning Magnetic Field (***N-SMF***, ***S-SMF***) [25]. Interaction of ***SMF*** produced Spinning Magnetic Force (***SMFs***) and orbital fusion [26], or Angle hair for electrons.

The electrons orbital magnetic force ($\boldsymbol{F_{ME}}$) is given by

$$F_{ME} = n_o B_{EE} B_{2e} r_{me}^2 c = n_o q v_c B_{EE} \quad N \qquad \{21\}$$

As shown in Fig.4 ***ExMF*** production increased from intense $\boldsymbol{B_{EI}}$ to maximum $\boldsymbol{B_{EE}}$, thus reducing radius of gyration from (a) to (b) to (c) leading to reduction of the circumference. This state is expressed by substituting $\boldsymbol{r_m}$ with $m_e v_c/qB_E$ hence

$$C = 2\,\pi\, r_m = \frac{2\,\pi\, m_e\, v_c}{q\, B_E} \quad m \qquad \{22\}$$

Relating Fig.4 with ***SMF*** radius $\boldsymbol{r_r}$ [25], and electron's radius [26], the circumference of gyrating particles is given by

$$C = n\,(\,2r_e \times 2r_r\,) \quad m \qquad \{23\}$$

Equivalent of Eqs.{22} and {23} gives the following ***SMF*** distance r_r

$$r_r = \frac{\pi\, m_e\, v_c}{2\, n_o\, q\, r_e\, B_E} \quad m \qquad \{24\}$$

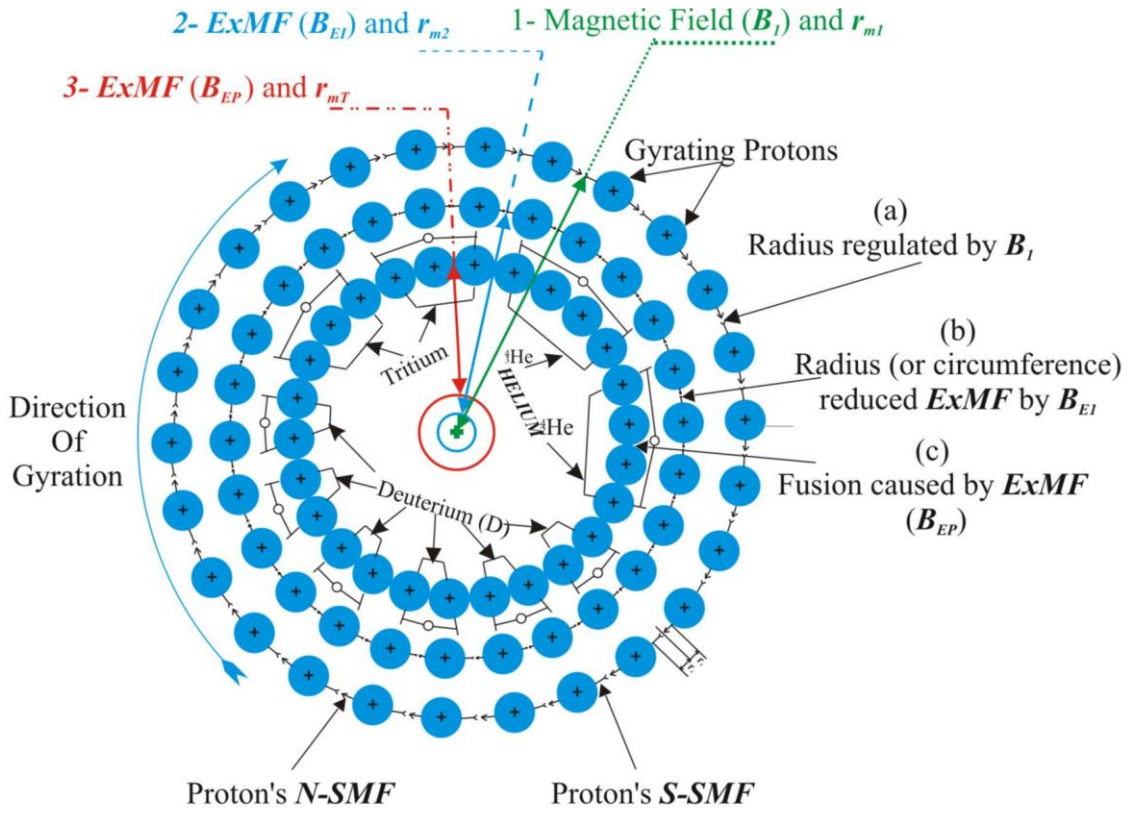

Fig.5. Cross-section of orbital gyrating protons showed by electrons in Fig.2. Produced external magnetic field (***ExMF***) given by $\boldsymbol{B_{EI}}$ to $\boldsymbol{B_{EE}}$, reduced the radius of gyration, orbital circumference, hence the distance between adjacent north (***N***) and south Spinning Magnetic Field (***SMF***) [25]. Interaction of ***SMF*** produced Spinning Magnetic Force (***SMFs***) and orbital fusion [26], where protons transformed into higher elements.

The ***ExMF*** needed to give required r_r for Electron-Electron interaction as shown in Fig.2, [26] is given by

$$B_E = \frac{\pi\, m_e\, v_c}{2\, n_o\, q\, r_e\, r_r} \quad T \qquad \{25\}$$

Therefore, distance r_r between adjacent electrons is reduced to fami range (10^{-15}), thus enhancing interaction of opposite spinning magnetic fields (***SMF***) [26], therefore, producing electrons-spinning magnetic force (***SMFs***) [26], leading to the electrons fusion. Due to these, the electron force ($\boldsymbol{F_{ME}}$) given by Eq.{21} will be greater or equal to Electron-Electron interaction ***SMFs*** [26], hence

$$F_{ME} \geq F_{S(EE)} \therefore n_o q v_c B_{EE} \geq \left(\frac{q^2}{4\pi\varepsilon_o r^2} + \frac{2n^2}{3}\frac{B_{TE}^2}{r_o 2(r_o + r_P)(n r_x)}\right) c \left(\frac{B_{TE}^2}{r_r^2} c + \frac{B_{TE}^2}{((r_o\, r_r) + r_o)^2} c\right) \quad N \qquad \{26\}$$

As state of Eq.{26}, is caused by $\boldsymbol{B_{EE}}$ of Eq.{20} resulted in $\boldsymbol{r_r}$ of Eq.{24}, electrons in orbits and along the line of force will fuse together, thus production of ***ExMF*** will be terminated, lengthy

fused electrons will be ejected from the system, like a long web, known in Ufology as Angle hair [29], gyration radius at this stage is

$$r_{mT} = \frac{n_o\, m_e\, v_c}{q\, B_{EE}} \quad m \quad \{27\}$$

Production of ***ExMF*** is ceased by condition given by Eq.{25}.

5:3 THE PROTONS FUSION

Like electrons, Fig.5 shows the sequences through which orbital protons radius is reduced, while maximum proton's ***ExMF*** produced (***B_{EP}***) is given by

$$B_{EP} = 10^8\,(\gamma_{PS}\, B_P^2 + \frac{\gamma_{PS}\, n_o\, O_n\, l\, q^3\, B_P^3}{m_P^2\, v_c\, c} \quad T \qquad \{28\}$$

Where, ***B_{EP}*** is the intense ***ExMF*** produced by the protons. Proton's orbital magnetic force (**F_{MP}**) is given by

$$F_{mP} = n_o\, B_{EP}\, B_2\, r_{mp}^2\, c = n_o\, q\, v_c\, B_{EP} \qquad N \qquad \{29\}$$

As shown in Fig.5, ***ExMF*** production increased from ***B_{EI}*** to maximum ***B_{EP}*** thus reducing gyrating radius from (a) to (b) to (c) leading to reduction of the circumference. This state is expressed by substituting r_m with $r_m=m_pv_c/qB_E$ hence

$$C = 2\,\pi\, r_m = \frac{2\,\pi\, m_p\, v_c}{q\, B_E} \quad m \qquad \{30\}$$

Relating Fig.5 with ***SMF*** radius ***r_r*** [25], and proton's radius [26], and Equivalent of Eqs.{23} and {30} the following is the ***SMF*** distance ***r_r***

$$r_r = \frac{\pi\, m_p\, v_c}{2\, n_o\, q\, r_p\, B_E} \quad m \qquad \{31\}$$

The ***ExMF*** needed to give required r_r for Proton-Proton interaction as shown in Fig.2, [26] is given by

$$B_E = \frac{\pi\, m_p\, v_c}{2\, n_o\, q\, r_p\, r_r} \quad T \qquad \{32\}$$

Therefore, distance ***r_r*** between adjacent protons is reduced to fami range (10^{-15}) thus enhancing interaction of opposite spinning magnetic fields (***SMF***), therefore, producing protons-spinning magnetic force (***SMFs***) or the nuclear force in [26], leading to the protons fusion. This occurred because the proton force (***F_{ME}***) given by Eq.{29}is greater or equal to Proton-Proton interaction ***SMFs*** [26], hence

$$F_{mP} \geq F_{S(PP)} \therefore n_o q v_c B_{EP} \geq \left(\frac{q^2}{4\pi\varepsilon_o r^2} + \frac{2n^2}{3}\frac{B_{TP}^2}{r_o 2(r_o + r_P)(n r_x)}\right) c \left(\frac{B_{TP}^2}{r_r^2} c + \frac{B_{TP}^2}{((r_o\, r_r) + r_o)^2} c\right) \; N \qquad \{33\}$$

The radius at which gyration is terminated, is given by

$$r_{mT} = \frac{n_o\, m_p\, v_c}{q\, B_{EP}} \quad m \quad \{34\}$$

6: PROTONS FUSION and RESULTED ENERGY

Since fusion is a reaction in which light nuclei combined to form a nucleus of larger mass [30], therefore fused gyrating hydrogen nucleus may form several nucleuses with accompanied energies. This is facilitated by the transformation of protons into neutrons with the ejection of beta particle [31, 26]. This is thought to be one of the crucial mechanism forming solar flares, but since the major particles ejected by solar flares composed of deuterium, tritium and both helium that constitutes the major ejected particles, although ${}^{3}_{2}H_e$ constitute majority in some flares [2], therefore fusion shown in Fig.5, may lead to the following possibilities.

6:1 THE DEUTERIUM

In Fig.5, two hydrogen nuclei fused to produce hydrogen isotope deuterium after a proton changed to neutrons, having nucleons of proton and neutron with the emission of one positron (β^+) [31, 26] with an accompanied energy, the reaction equation is given by

$$2\,({}^{1}_{1}H) \rightarrow {}^{2}_{1}H + \beta^+ + Q \qquad \{35\}$$

If fused protons in the field volume given by Eq.{19} produces deuterium isotope, energy released for this interaction is 1.8 MeV, therefore, total energy resulted from deuterium reaction is given by

$$Q_{TD} = \frac{(1.8)(10^8\, n_o\, O_n\, l\, B_1)}{2\,({}^{1}_{1}H)} \quad MeV \qquad \{36\}$$

6:2 THE TRITIUM

In Fig.5, three hydrogen nuclei fused to give hydrogen isotope tritium, having nucleons of one proton and two neutrons, with the emission of two positrons (β^+) [31], and accompanied energy, the reaction equation is given by

$$3\,({}^{1}_{1}H) \rightarrow {}^{3}_{1}H + 2\,\beta^+ + Q \qquad \{37\}$$

If all protons fused into tritium, while energy Q, released for the above interaction is 7.5 MeV, therefore, total resulted energy is given by

$$Q_{TT} = \frac{(7.5)(10^8\, n_o\, O_n\, l\, B_1)}{3\,({}^{1}_{1}H)} \quad MeV \qquad \{38\}$$

6:3 THE HELIUM

Fusion of four hydrogen nuclei as shown in Fig.5, could be transformed into the following helium products

6:3:1 THE HELIUM ISTOPE ${}^{3}_{2}H_e$

The reaction equation for helium isotope ${}^{3}_{2}H$ is given by

$$4\,({}^{1}_{1}H) \rightarrow {}^{3}_{1}H_e + {}^{1}_{0}n + 2\,\beta^+ + Q \qquad \{39\}$$

If all protons fused into helium isotope, as usually occurred in the sun [2], while energy Q released, by above interaction is 6.7 MeV, therefore, resulted energy given by

$$Q_{THe} = \frac{(\ 6.7\ \times\ 10^8)(n_o\ O_n\ \ l\ B_1\ )}{4\ (^1_1H)} \quad MeV \qquad \{40\}$$

6:3:2 THE HELIUM $^4_2H_e$

The reaction equation for helium ^4_2H is given by

$$4\ (^1_1H) \rightarrow\ ^4_2H_e +\ 2\ \beta^+ +\ Q \qquad \{41\}$$

If all protons fused into helium, while energy Q, released for the above interaction is 24.7 MeV, therefore, resulted energy is given by

$$Q_{THe} = \frac{(\ 24.7\ \times\ 10^8)(n_o\ O_n\ \ l\ B_1\ )}{4\ (^1_1H)} \quad MeV \qquad \{42\}$$

6:3:3 THE RELATIVE FUSION and ENERGY PRODUCTS

Since natural abundance of deuterium is 0.015%, tritum is 0.001%, helium isotope is 0.000138% and 99.999862 for helium [32], and therefore, the following are thought to be an estimated final percentage of the fusion product and energy

$$Q_{THe} = \frac{(0.015\% \times 1.8) + (0.0015\% \times 7.5) + (0.000138\% \times 6.7) + (99.983862\% \times 24.7) + (+(10^8 n_o O_n l B_1)}{2\ (^1_1H) + 3(^1_1H) + 4(^1_1H)}\ MeV \quad \{43\}$$

The energy could be given by

$$Q_{TE} = (0.0135 + 0.0025 + 0.00023115 + 617.4003479)(10^8 n_o O_n l B_1) \quad MeV \quad \{44\}$$

Therefore; the total energy is given by

$$Q_{TE} = 617.416579 \times 10^8 n_o O_n l B_1) \quad MeV \quad \{45\}$$

6 CONCLUSION

1- This work is aimed at forming a base upon which, better understanding and development could be achieved in these immense field.
2- The produced ExMF is opposite in direction to the field producing it.
3- In the system where magnetic lines of force is moving or rotating, captured charged particles velocity ($\boldsymbol{v_c}$) is fixed, whatever energization process that takes place.
4- An increase in the rotating magnetic field ($\boldsymbol{B_1}$), appears as ***ExMF*** ($\boldsymbol{B_E}$), thus leading to new state of energization process.
5- The total amount of energy acquired by charged particles in moving or rotating magnetic lines of force is the summation of gained energy due to change in $\boldsymbol{B_{EI}}$.
6- Proton's energies shown in Table.1 is related to production of ***ExMF*** [33].
7- Magnitude of ***ExMF*** ($\boldsymbol{B_{EI}}$) represents that amount produced at specific stage.
8- Solar flares and related emission of x-ray, e.u.v. and acceleration of ^3_2He and ^4_2He are the consequences of the nuclear fusion resulted from the intense ***ExMF*** as produced by charged particles before flare stage.
9- Detected magnetic field at around ± 13.6 Re that fluctuated in magnitude and direction, referred to as ***IMF*** [34] is thought to be the produced ***ExMF***.

10- Energy obtained in sec-6:00 resulted from proton's fusion, could be derived using Eq.{15} in spinning magnetic force (or nuclear force) [26].
11- This work aimed at better understanding of solar cycle's present changes among other [35].
12- Tables. 1 & 2 are simplified, to give the general idea of deriving both ***ExMF*** and spectrum energies.
13- Using Eq.{8}, the value of ***B*** is derived from Table.1&2, gives 20 nT.
14- The Forbush decrease in Cosmic-rays, is related to the accomplishment energization steps further than the 4th step.

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