The Solar Flare Mechanism

By: Mahmoud E. Yousif

e-mail: yousif@exmfpropulsions.com

C/O Physics Department - The University of Nairobi

P.O. Box 30197 - Nairobi-Kenya

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ABSTRACT

Solar flares are the enormous nuclear explosion occurs inside or on the solar peripheries. The earlier produced pairs of sunspots pillars consist of electrons and protons, both of which produced intense external magnetic field (***ExMF***). Gyrating protons radius in the pillars are constantly reduced by increased ***ExMF***, this with nearby ***ExMF*** produced by electrons pillars, allowed for either of two types of solar flares, 1- The Natural Triggered Flare Mechanism (***NTFM***), and 2- The Triggered Magnetic Connection (***TFMR***). The triggered nuclear fusion, produced electromagnetic radiation, different combination of particles and enormous energy, all of which related to level of the explosion, which is based on protons involved.

1:00 Introduction

Solar flares are the most famous aspect of solar activities, they are intense, short-lived releases of energy, seen as bright areas on the Sun in optical wavelengths and as bursts of noise in radio wavelengths; they can last from minutes to hours, and they are the largest explosive events that occurs in the solar system. The primary energy source for flares were thought to appears from the tearing and connection of strong magnetic fields [1].

The output radiation of flares covers throughout the electromagnetic spectrum, from gamma rays to x-rays, through visible light out to kilometer-long radio waves, NOAA/SEC images [2], SOHO and SDO movies [3], [4], showed the link between Sunspots and the eruption process igniting the solar flares and prominence.

Geomagnetic activities, such as aurora, are caused by charged particles resulted from Solar flares, while intense flare may damage telecommunications, electricity, telegraphs and communication satellites [5]. Solar flares are associated with the sunspots and the intense magnetic fields produced by these sunspots, in a process known as the magnetic connection [1]. The mechanism through which the magnetic connection undergoing to initiate solar flare is unknown [6].

Solar flare mechanism was tackled in the Universal Energies (***UE***) [7], in which the explosion was interpreted as nuclear fusion, and initiated by the external magnetic field (***ExMF***), both the nuclear fusion and ***ExMF*** in addition to the energization of charged particles were considered the trio elements of the UE [7].

The famous prominence eruption arising and falling back into a spinning sunspot first aired by the Solar Dynamic Observatory (SDO) [8], inspired to revisit the solar activities, which resulted in the sunspots mechanism [9], and since sunspots and solar flare are closely related, therefore, the solar flare is re-expanded to include the main two types of solar flares and different related mathematical equations.

This paper, showed solar flares relation with sunspots and sequences of events inside protons sunspots pillars that triggered the nuclear fusion and internal and external ***ExMF*** role in producing that. The two types of trigger process are, (a) The Natural Triggered Flare Mechanism (***NTFM***) and (b) The Triggered Magnetic Connection (***TFMR***).

As the mechanisms of solar activities are not well understood, this paper may help providing that, and to harness the vast energies available in these transformation and above all understanding the process which may help protecting earth orbital communication satellites and to secure continuation of human species.

The paper is built on previous magnetic interaction (***MIH***) [10] and related Spinning Magnetic Force (***SMFc***) [11], and the Elements of Magnetic Lines of Force (***EMLF***) [12], all of which formed the bases upon which several phenomena were explained, the mechanism of each phenomenon may change but the bases upon which they are structured is the same.

2:00 Sunspots and The Solar Flares

Although a link between solar flare and nuclear fusion was earlier suggested, but rejected due to low densities in upper chromosphere or lower corona [1], this school of thought is the one lead to tokamak model [13] as the only means to ignite and sustain nuclear fusion.
The positive sunspots, composed of protons particles, and the negative sunspots composed of electrons particles, are produced and ejected from tachocline zones, then appearing on solar surface and moved towards the polar region, Fig.1 in Sunspots Mechanism [9], shoed cross section of the two sunspots pillars, before ejection, solar activities started at appearance of these sunspots effects on photosphere [14], marking the starting of the solar cycle.
Since Solar flares is greatly related to the sunspots appearance, it is also found that flares usually occurs near and along the dividing line (neutral line) between areas of oppositely directed magnetic fields of sunspots [15], and the development of flares seems to be the same regardless of the their sizes, with filamentary structure, production of ($\mathbf{H_e^3}$), high energies particles which are thrown from flare region, with total energy that can amount to 10^{23} Joules [1].

The current Eddington stars model [16], and nuclear fusion model developed by Hans Albrecht Bethe in1938 [17], [18], limited fusion reactor to stars inner cores [19] which is the source of above tokamak model [13], where some physicists started questioning that model [20].

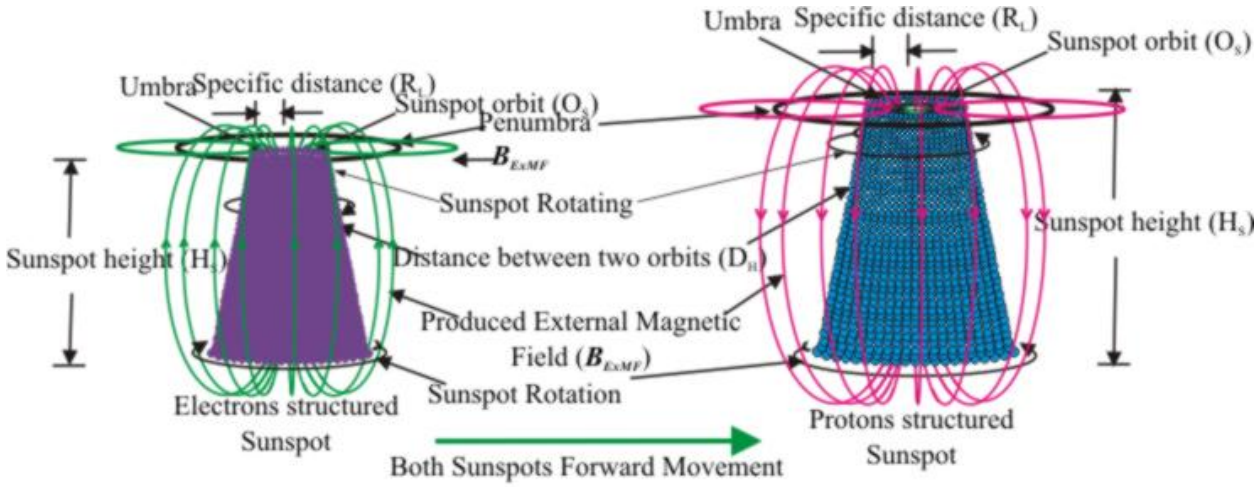

Fig.1. Both the electrons and protons sunspots, it also shows some parameters. Penumbra formed by granules at photosphere.

The Solar flares are thought to represents nuclear fusion, ignited through one of two mechanisms:

(a) The Natural Triggered Flare Mechanism (***NTFM***).

(b) The Triggered Flare Magnetic Connection (***TFMR***).

In both assumptions, flares are caused by sunspots which are always moving in pairs with different polarities [9], [21] as shown in Fig.1, where the shorten of magnetic lines of force and release of magnetic energy, means the connection of two tubes of force interchange their end points [22], only represents start of sequence of events.

3:0 The Natural Triggered Flare Mechanism (NTFM)

The formation and movement of protons pillars shown in Fig.1, produced ***ExMF*** with intensity continually building up [9], each pillar attracts more protons (or electrons) while moving towards the photosphere (or towards both polar), the radius of gyration**,** starts reduced, with intense produced ***ExMF***. The magnetic force exerted on each gyrating particle is:

$$\boldsymbol{F_m = B_{Ex}\, B_{p(e)}\, r_m^2\, c} \qquad \boldsymbol{N} \quad \{1\}$$

Where, $\boldsymbol{B_{Ex}}$ is the continual produced ***ExMF***, $\boldsymbol{B_{p(e)}}$ is protons or electrons circular magnetic field (***CMF***) [10] in Tesla, $\boldsymbol{r_m^2}$ is the magnetic radius in meter, C is the speed of light in m. s^{-1}, the magnetic force $\boldsymbol{F_m}$ is in Newton.

The produced ***ExMF*** reflected in the energization of both electrons and protons increasing their energies [10, 7, 23, 9].

The intense produced ***ExMF*** decreased radius of gyration for all protons (or electrons), and reduced distances between any two adjacent electrons and protons [7], this field is given by.

$$\boldsymbol{B_{SEI}} = \left(\gamma_{PS} \left(B_{1\rightarrow n} + \frac{(n_m) l q^3 B_{1\rightarrow 1}^2}{m^2\ v_c\ c} \right) \right) \quad \{2\}$$

Where, $B_1 \rightarrow n$ is the previous magnetic field (starting with original field B_1) in Tesla, c is speed of light in $m.s^{-1}$, ***l*** is the effective length of the magnetic lines of force (along which charged particles gyrates) in meters, q is the elementary charge in Coulomb, n_m is the number of charged particles along one meter length, m is the mass of charged particles in kg, v_c is velocity of captured charged particle in $m.s^{-1}$, γ_{ps} is the relative magnitudes of the primary and secondary ***ExMF*** in the final production of solar ***ExMF*** [23], and the produced $\boldsymbol{B_{SEI}}$ is in Tesla.

Protons (or electrons) gyrate in orbits inside sunspots pillars shown in Fig.1, the circumferential distance of any orbit is designated by sunspot orbit (O_S), and protons and electrons radius is designated by $\boldsymbol{r_{p(e)}}$ and stability distances in spinning magnetic force or nuclear fusion ignition radius is $\boldsymbol{r_r}$ [11] as shown in Fig.2, the number of protons or electrons fused in an orbit is given by

$$N_O = \frac{O_{S1}}{2r_{p(e)} \times\ r_r} = \frac{O_{S1}}{(2 \times 0.55^{-15}) \times\ (2x0.7^{-15})} = \frac{2\pi r_{o1}}{(2 \times 0.55^{-15}) \times (2 \times 0.7^{-15})} \quad \{3\}$$

Where, $\boldsymbol{O_{S1}}$ is sunspot first circumferential orbit in meter, $\boldsymbol{r_{p(e)}}$ is proton or electron radius in meters, $\boldsymbol{r_r}$ is the nuclear fusion ignition radius in spinning magnetic force (***SMFc***) shown in Fig.5 at ***SMFc*** [10] [11], or Fig.2 bellow in meter, $\boldsymbol{r_{o1}}$ is the first orbital radius in a sunspot in meter, and $\boldsymbol{N_O}$ is the number of protons or electrons in each orbit.

At fusion, protons (or electrons) number along the sunspots height shown in Fig.1, is given by

$$N_H = \frac{H_S}{2r_{p(e)} + D_H} = \frac{H_S}{1.1^{-15} + 10^{-10}} \quad \{4\}$$

Where, $\boldsymbol{H_S}$ is the effective sunspot height in meters, $\boldsymbol{D_H}$ is the distance between two gyrating orbits in meters, and $\boldsymbol{N_H}$ is the number of protons or electron along the height.

Particles fused in a lengthy Sunspot orbits are multiplication of both Eq.{3} and {4}, result of which is given by:

$$N_{LO} = \frac{2\,\pi r_o \times\ H_S}{1.000036^{-10}} \quad \{5\}$$

Where, $\boldsymbol{N_{LO}}$ is the total number of fused protons or electron in a lengthy orbit.

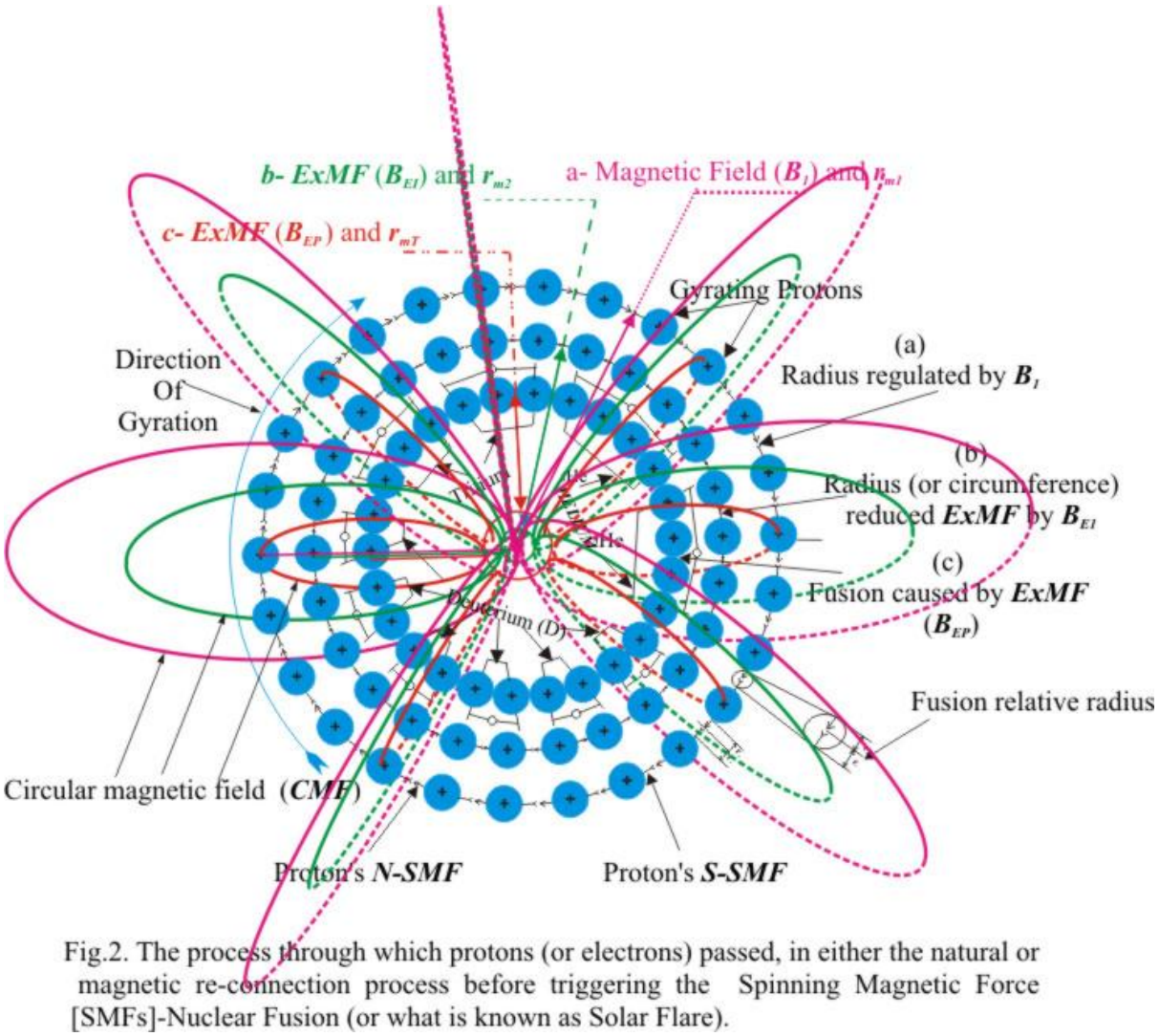

Fig.2. The process through which protons (or electrons) passed, in either the natural or magnetic re-connection process before triggering the Spinning Magnetic Force [SMFs]-Nuclear Fusion (or what is known as Solar Flare).

The number of orbits along a specific lengthy distance R_L is given by:

$$O_{Sx} = \frac{R_L - 2r_o}{2r_{p(e)} + D_O} \quad \{6\}$$

Where, D_O is the distance between orbits, and O_{Sx} is numbers of orbits along specific distance. Combining Eq.{5} and Eq.{6}, gives the total number of protons or electrons fused in sunspot, it is given by:

$$N_{ST} = \frac{(R_L - 2r)}{(1.1^{-15} + 10^{-10})} \times \frac{(2\,\pi\, r_O \times H_S)}{(1.000036^{-10})} \quad \{7\}$$

Where, $\boldsymbol{N_{ST}}$ is the total number of fused protons or electrons in sunspot.

From the Universal Energies [7], the orbital magnetic force given by Eq.{1} on an orbital protons or electrons, is given by

$$F_{me} = N_O B_{EE} B_{2p(e)} r_{me}^2 \, c = \; N_O q v_c B_{EE} \;\; \{8\}$$

While near the photosphere or deep inside the sun, sunspots ***ExMF*** increased from intense $\boldsymbol{B_{SEI}}$ to maximum $\boldsymbol{B_{SEE}}$, this state is shown by the three levels radial reduction in Fig.2, thus radius of gyration reduced from (a) to (b) to (c), therefore the circumference is reduced. This state is expressed by substituting $\boldsymbol{r_o}$ in the following equation with $\boldsymbol{m_e v_c / q B_E}$ hence

$$C = 2\pi r_o = \frac{2\pi m_{p(e)} v_c}{q B_{SEI}} \quad m \quad \{9\}$$

Relating Fig.3 with nuclear fusion ignition (***SMFc***) radius $\boldsymbol{r_r}$ [7], and proton's (or electron's) radius [10], the circumference of gyrating particles in Eq.{3} is given by

$$C = \; O_{s1} \; = N_o \left(2 r_{p(e)} \times \; 2 r_r\right) \quad m \quad \{10\}$$

Substituting Eq.{10} in Eq.{9} gives the following ***SMF*** distance $\boldsymbol{r_r}$

$$r_r \; = \; \frac{\pi \, m_{p(e)} \, v_c}{N_o \; q \;\; B_{SEI}} - \; r_{p(e)} \qquad m \qquad \{11\}$$

The intensity of ***ExMF*** ($\boldsymbol{B_{TEx}}$) needed to trigger required distance of $\boldsymbol{r_r}$ for Proton-Proton (or Electron-Electron) interaction previously shown in Fig.2 at the ***SMFc***, [11] is given by

$$B_{TEx} = \frac{\pi \, m_{p(e)} \, v_c}{N_o \; q \; (r_{p(e)} + \; r_r)} \qquad T \qquad \{12\}$$

Therefore, distance $\boldsymbol{r_r}$ between adjacent proton (or electrons) is reduced to fami range (10^{-15}), thus interaction of opposite spinning magnetic fields (***SMF***) is enhanced [11], and the protons (or electrons)-spinning magnetic force (***SMFs***) is produced [11], therefore nuclear fusion of protons (or electrons) fusion is achieved. The latest composed movie by both the SOHO and SDO clearly shoed magnetic movements before the explosion [24].

Due to these, the protons (or electrons) force ($\boldsymbol{F_{MP(E)}}$) given by Eq.{8} will be greater or equal to Proton-Proton (or Electron-Electron) interaction force ($\boldsymbol{F_{SPP}}$(EE)) ***SMFs*** [11], hence

$$F_{MP(E)} \geq \; F_{SPP(EE)} \;\; \therefore \;\; N_o q v_c B_{EE} \; \geq$$

$$\left\{ \frac{q^2}{4\pi\varepsilon_0 \, r^2} + \frac{2n^2}{3} \frac{B_{TP(E)}^2}{r_o (2(r_o + r_p) \, (n r_x)} \right) c \left(\frac{B_{TP(E)}^2}{r_r^2} c + \frac{B_{TP(E)}^2}{((r_o + r_r) +)^2} \; c \right) \quad N \; \{13\}$$

Where, the $\boldsymbol{F_{SPP(EE)}}$ is the spinning magnetic force ($\boldsymbol{SMFc}$) (or nuclear force for nucleons), in Newton.

Fig.3. The Connection of two magnetic field lines, showing the s-shape, but what happened down at the two spots? Credit: NASA/Marshall Space Flight Center [25].

As state, Eq.{13} is caused by $\boldsymbol{B_{SEE}}$ of Eq.{2} resulted in $\boldsymbol{r_r}$ of Eq.{11}, all protons (or electrons) in orbits along the sunspot height will fuse together, thus ***ExMF*** production will ceased, energetic electrons will be ejected and escalated from the system, while protons fusion will generate great amount of energy and the triggered gyrating radius ($\boldsymbol{r_{mT}}$) at this stage is

$$r_{mT} = \frac{N_o m_{P(E)} v_c}{q B_{EM}} \; m \quad \{14\}$$

Production of ***ExMF*** is ceased by condition given by Eq.{12}.

This process takes long period of time, the nuclear fusion occurred along the first or multiple inner orbits of gyrating protons, depends on the magnitude of produced ***ExMF***, therefore fusion of such process works in a similar manner like an iris, where an increased ***ExMF***, forced protons radius to be reduced, until eruption occurred.

ExMF produced from such natural solar flare eruption may produced intense ***ExMF***, that may trigger sequence of other flares within the same sunspot spatial.

4:0 The Triggered Flare Magnetic Connection (TFMR)

From observations and studies of different flares, it became known that sunspots group with complex magnetic field configurations, often are sites of flares [25], it was discovered that, the solar magnetic field lines forming the letter 'S', to be connected, it's like a coronal short circuit, causing the coronal mass ejection (CME), thus solar flare occurred due to Connection of sunspots magnetic field [26], the connection depicted by an artist shown in Fig.3 [27] showed the two sunspots and the connection of two magnetic poles, resulted in a sudden violent movements, and abruption of different electromagnetic radiations of various wavelength with sudden massive flow of charged particles from the solar surface, all these takes from minutes to as long as hours [28].

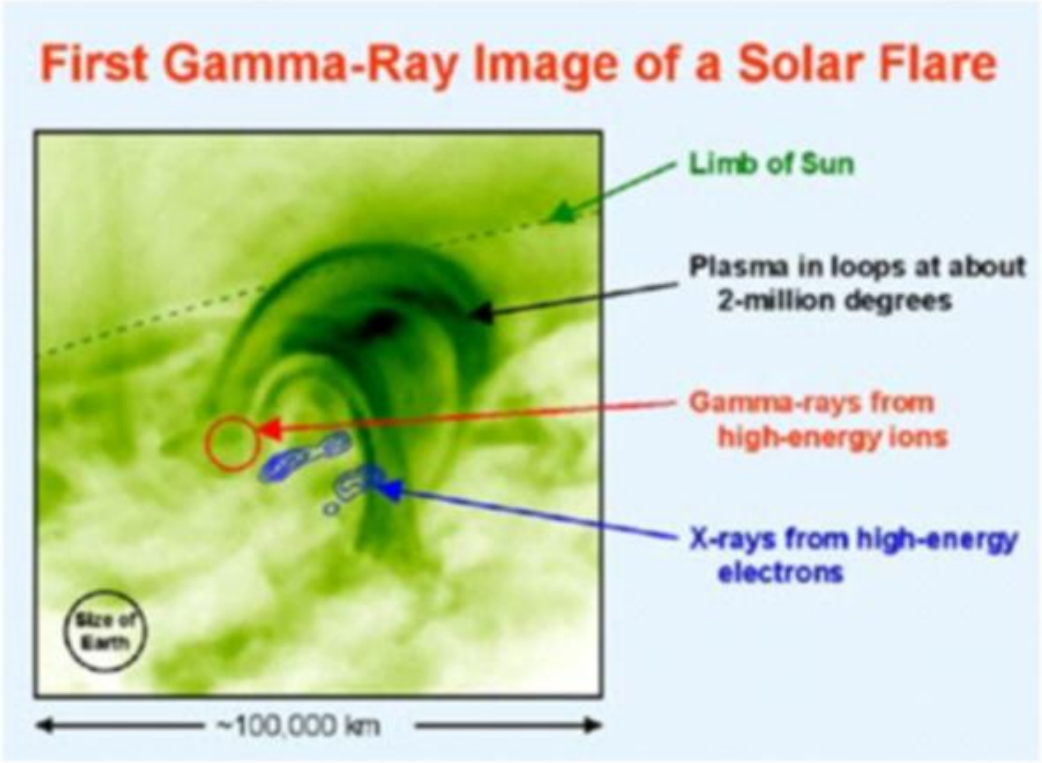

Fig.4. The solar flare (or Nuclear Fusion) of two sunspots, triggered by magnetic connection, the protons pillars producing Gamma-rays among others, while x-rays produced by electrons pillars [35].

The above discussed ***NTFM***, takes longer period to reach nuclear fusion triggered status, while in triggered flare magnetic Connection (***TFMR***) nuclear fusion, eruption occurred when ***ExMF*** produced by both electrons and protons Sunspot pillars shown in Fig.1, suddenly interacted, shortening their magnetic fields and reducing gyrating radius.

Since both the negative and positive pillars, moves alongside while gyrating in opposite direction [29], shown in Fig.1, and as computerized assimilated [30] therefore, intense produced ***ExMF***

occasionally comes into each other's fields influences, producing the spark and igniting the flare [31], when the distance between both sunspots shortened, or both ***ExMF*** are intense, as shown by the x-rays photo of the s-shape region shown in Fig.3 [32], these regions of different polarities interacted magnetically [10], resulted in magnetic force given by Eq.{1}, becomes

$$F_{sr} = B_{PS} B_{ES}\, r_{PES}^{2}\; c \qquad N \quad \{15\}$$

Where, $\boldsymbol{B_{PS}}$ and $\boldsymbol{B_{TEx}}$ are the ***ExMF*** produced by protons and electrons sunspots in Tesla, $\boldsymbol{r_{PES}^{2}}$ is the distance between the two sunspots in meters, c is the speed of light in $m.s^{-1}$, the sunspots Connection force $\boldsymbol{F_{rc}}$ is in Newton.

The interaction of two such massive ***ExMF*** is synonymous to square root of Eq.{2} thus

$$\boldsymbol{B}_{MTEx} = \left(\gamma_{PS}\left(B_{1\to n} + \frac{(n_m) l q^3 B_{1\to 1}^2}{m^2\, v_c\, c}\right)\right) \times \left(\gamma_{PS}\left(B_{1\to n} + \frac{(n_m) l q^3 B_{1\to 1}^2}{m^2\, v_c\, c}\right)\right) \quad \{16\}$$

Where, $\boldsymbol{B_{MTEx}}$ is the sunspot momentarily Triggered ***ExMF***.

But above produced $\boldsymbol{B_{MTEx}}$ is greater than the magnetic fields required by Eq.{12} to shorten $\boldsymbol{r_r}$ distance for Proton-Proton (or Electron-Electron) interaction, shown in Fig.2, [11], thus we get

$$\boldsymbol{B_{MTEx}} \geq\geq \boldsymbol{B_{TEx}} = \frac{\pi\, m_{p(e)}\, v_c}{N_o\, q\, (r_{p(e)} + r_r)} \quad T \quad \{17\}$$

This sudden ***ExMF*** increases, decreased the orbital radius, and distance $\boldsymbol{r_r}$ between adjacent proton (or electrons) to fami range (10^{-15}), the ***SMF*** of adjacent protons comes into the influence of each other [11], therefore protons in several lengthy orbits interacts thus producing the ***SMFc*** or the nuclear force, which in turns produced the nuclear fusion or the Solar Flare starting with the A Large Moreton wave which look like Tsunami Shock Wave [33, 34, 35].

This sudden violence eruption is stronger than the ***NTFM***, because it trigger several lengthy orbital layers, and differ in time factor to achieve the interaction process, where interactions of ***ExMF*** accelerates the flare process.

5:0 Solar Fusions And Related Flares Energies:

Energy given by solar flares in minutes can exceed that given by 100 hurricanes on Earth [28], flares ejected electrons up to 10 MeV and nucleons to hundreds of MeV [22], these are particles gained energies through energization process inside the sunspots [9], [7], [10] and resulted fusions, but energy produced by solar flare is proportional to involved protons number in this nuclear fusion and the final reaction output, therefore, energies produced by solar flares or any similar system composed of following energies:

1- Charged particles energies gain from energization process.

2- Energy resulted from fusion interaction.

3- Related electromagnetic radiation.

Since natural abundance of deuterium is 0.015%, tritium is 0.001%, helium isotope is 0.000138% and 99.999862 for helium [36], the following is thought to be an estimate of final fusion energy product related to these proportionalities [7]

$$Q_{THe} = \frac{(0.015\%\times 1.8)+(0.0015\%\times 7.5)+(0.0001338\%\times 6.7)+(99.98386\%\times 24.7)}{2\left({}_1^1H\right)+3\left({}_1^1H\right)+4\left({}_1^1H\right)+4\left({}_1^1H\right)} \quad \{18\}$$

Where, Q_{THe} is the energy released due to fusion interaction.

From Eq.{18}, the total energy resultant from sunspots fusion reaction is given by

$$Q_{TE} = N_{ST}\,(617.416579) \qquad MeV \quad \{19\}$$

Where, N_{ST} is the total sunspot protons involve in such fusion reaction. Since the total number of protons ($\boldsymbol{N_{ST}}$) involved in such ***SMFc*** interaction, or nuclear fusion was given by Eq.{8}, therefore multiplying this with energy produced by fused nuclei, given by Eq.{19}.

Therefore, solar flare energy $\boldsymbol{Q_{SF}}$ is given by

$$\boldsymbol{Q_{SF}} = (617.416579)\left(\frac{(R_L - 2r)}{(1.1^{-15} + 10^{-10})} \times \frac{(2\,\pi r_O \times H_S)}{(1.000036^{-10})}\right) \qquad MeV \quad \{20\}$$

Solar flare fusion triggered by the magnetic flare connection process, involved both the positive protons and negative electrons sunspots, this explains radiation of both Gamma-Rays by ions and X-rays by electrons during and within two different nuclear reactions, triggered by a ***TFMC***, thus exploding solar flares energetic electrons and ions as shown in Fig.4, [37]. The flare observations showed, sources of both rays are very fare, they were electrons and ions, the gamma- rays is coming from feet of large magnetic field loops, while the X-rays come from the feet of the small magnetic loops near the larger ones [38], this can be compared with Fig.1.

Since 1 M eV = 1.60 x 10^{-12} j, and 1 Joule/Sec = 1 Watt, therefore Eq.{20} becomes:

$$Q_{SF} = (9.8787)\left(\frac{(R_L - 2r)}{(1.1^{-15} + 10^{-10})} \times (2\,\pi r_O \times H_S)\right) \qquad Joules \quad \{21\}$$

But since Solar Flares are classified based on their X-rays output, that is in accordance to the magnitude order of the peak burst intensity (I), measured at earth in the 0.1 to 0.8 nm [39], therefore the output of the solar flare given by Eq.{21} and measured on the earth, will give the following classification:

$$C_{SF} = Q_{SF} \div R_{RF} = \left(\frac{(19.757\,\pi r_O\, H_S\,) \times (R_L - 2r)}{(1.1^{-15} + 10^{-10})}\right) \div R_{RF} \quad Watts/m^2 \quad \{22\}$$

Where, $\boldsymbol{R_{RF}}$ is a reduction factor related to present system of solar flare classification [40], the solar flare class $\boldsymbol{C_{SF}}$, is in Watts per square meter.

Acrimony Used in This Paper

$B_1 \rightarrow n$ is the previous magnetic field (starting with original field B_1)

$\boldsymbol{B_{Ex}}$: Continual produced ***ExMF***

$\boldsymbol{B_{MTEx}}$: Sunspot momentarily Triggered ***ExMF***.

$\boldsymbol{B_{SEI}}$: Produced intense external magnetic field.

$\boldsymbol{B_{p(e)}}$: Protons or electrons circular magnetic field (***CMF***)

$\boldsymbol{B_{PS}}$ and $\boldsymbol{B_{TEx}}$: The ***ExMF*** produced by protons and electrons sunspots.

$\boldsymbol{B_{TEx}}$: Intensity of ***ExMF*** needed to trigger required distance of $\boldsymbol{r_r}$ for Proton-Proton (or Electron-Electron) interaction

C : Speed of light.

CME : Coronal mass ejection

$\boldsymbol{C_{SF}}$: Solar flare class in Watts per square meter.

$\boldsymbol{D_H}$: Distance between two gyrating orbits.

$\boldsymbol{D_O}$: Distance between sunspot orbits.

EMLF : Elements of Magnetic Lines of Force

ExMF : External Magnetic Field

$\boldsymbol{F_m}$: Magnetic force

$\boldsymbol{F_{rc}}$: Sunspots Connection force.

$\boldsymbol{F_{SPP(EE)}}$: Spinning magnetic force (***SMFc***) (or nuclear force for nucleons)

$\boldsymbol{H_S}$: Effective sunspot height.

l : Effective length of the magnetic lines of force (along which charged particles gyrates).

m : Mass of charged particles.

$\boldsymbol{MIH}$: Magnetic Interaction Hypothesis.

$\boldsymbol{N_H}$: Number of protons or electron along the height.

$\boldsymbol{N_{LO}}$: Total number of fused protons or electron in a lengthy orbit.

$\boldsymbol{N_O}$: Number of protons or electrons in each orbit.

n_m : Number of charged particles along one meter length

NOAA/SEC: National Oceanic and Atmospheric Administration

$\boldsymbol{N_{ST}}$: Total number of fused protons or electrons in sunspot.

N_{ST} : Total sunspot protons involve in fusion reaction.

$\boldsymbol{O_{S1}}$: Sunspot first circumferential orbit.

O_S : Circumferential distance in sunspot orbit.

O_{Sx} : Numbers of orbits along specific distance.

q : Elementary charge.

$\boldsymbol{Q_{SF}}$: Solar flare energy

Q_{THe} : Energy released due to fusion interaction.

R_L : Number of orbits along a specific lengthy distance

$\boldsymbol{r_m^2}$: Magnetic radius.

$\boldsymbol{r_{mT}}$: Triggered gyrating radius

$\boldsymbol{r_{o1}}$: First orbital radius in a sunspot.

$\boldsymbol{r_{PES}^2}$: Distance between two sunspots.

$\boldsymbol{r_r}$: Stability distances in spinning magnetic force(***SMFc***) or nuclear fusion ignition radius.

$\boldsymbol{R_{RF}}$: Reduction factor related to present system of solar flare classification

$\boldsymbol{r_{p(e)}}$: Proton or electron radius.

SDO : Solar Dynamic Observatory

SOHO : Solar and Heliospheric Observatory

SMFc : Spinning Magnetic Force

NTFM : Natural Triggered Flare Mechanism

TFMR : Triggered Magnetic Connection

UE : Universal Energies

v_c : Velocity of captured charged particle.

γ_{ps} : Relative magnitudes of the primary and secondary ***ExMF*** in the final production of solar ***ExMF***

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