[Home Page](#)

THE MAGNETIC INTERACTION

(Modified)

Mahmoud E. Yousif
E-mail: yousif@exmfpropulsions.com/
$^{C}/_{O}$ *Physics Department - The University of Nairobi*
P.O.Box 30197 Nairobi-Kenya

PACS No: 41.20.-q, 21.10.Hw, 21.30.-x, 94.20.Qq, 94.10.Rk, 34.20.Cf, 32.10.Dk, 34.50.Fa, 32.30.-r

ABSTRACT

A magnetic interaction hypothesis ***(MIH)*** is suggested which leads to a re-interpretation of the interaction mechanism for the magnetic force. This ***MIH*** is used to explain energization of charged particles on micro scale. Further considerations including the nuclear force, inter-atomic stability, and the reproduction of spectral lines, are reported.

1:0 INTRODUCTION

Energization mechanism for charged particles has been a subject of much interest in the plasma physics [1]. The Sun emits these particles during various phenomena (such as, the solar flares, and the solar wind), [2,3] all of which interact with the geomagnetic field giving rise to several phenomena such as, the ring current, the Van Allan radiation belt, and the aurora in which the particles are highly accelerated, [4,5,6]. Many theories have tried to explain such accelerations. Among them are: acceleration by hydromagnetics shock waves, acceleration through atmospheric dynamo process, and the electric field acceleration [3]. But they have not been able to duplicate or explain the energization mechanism causing these phenomena [7]. Disclosing of this mechanism could help unlocking many of present unsolved mysteries, such as, the nuclear force formula [8], nuclear fusion mechanism [9], aurora mechanisms [10] and several other phenomena [11]. It is known that the forces keeping electrons around nucleus, are both the electrostatic and the electromagnetism [12], but no mechanism had been suggested for it. This paper however tries to tackle these problems by (I) re-interpreting the nature and mechanism of the magnetic force, and (ii) suggesting a magnetic interaction hypothesis (***MIH***), through which any generalised magnetic field interacts with a circular magnetic field (***CMF***) and (iii) re-defining the spinning magnetic field (***SMF***) interaction in terms of the nuclear force that binds the nucleons. Using both the ***CMF*** and ***SMF*** the atom formation, inter-atomic energization processes and the reproduction of the spectral lines are considered. ***MIH*** was published in 2003 [13], the present modification re-address among others, the inter-atomic forces.

2:0 THE MAGNETIC FORCE

2:1 THE CIRCULAR MAGNETIC FIELD (CMF)

Through experience [14], the attractive and repulsive forces between two conductors C_1 and C_2 carrying electric currents I_1 and I_2 separated by distance d metre, adopted for the definition of electric current [14], is given electrically by

$$F_{e.e.} = \frac{2\,k\,l_1\,I_1\,I_2}{d}\ \ N \qquad (1)$$

But since the above conductors (***C₁*** and ***C₂***) carrying electric currents ($\boldsymbol{I_1}$ and $\boldsymbol{I_2}$) therefore, the circular magnetic field (***CMF***) produced by each at a distance $\boldsymbol{r_C}$ from the conductor is given by

$$B_{C1} = B_{C2} = \frac{2\,k\,I_{1(2)}}{r}\ \ T \qquad (2)$$

Where, k= $2\text{x}10^{-7}$ Newton per square ampere [12].
As supposed by Faraday [15] magnetic lines of force tends to shorten in length or repelling one another sideways, such that the force obtained by Eq.(1) could be conceived as due to both conductor's ***CMF*** shorten or repelling each other, as shown in Fig.1 and Fig.2, such that the repulsive and attractive force is give magnetically by

$$F_m = \frac{B_{c1}\,B_{c2}\,r_1\,r_2\,l_1}{2k}\ \ N \qquad \{3\}$$

Where, both $\boldsymbol{B_{c1}}$ and $\boldsymbol{B_{C2}}$ are ***CMF*** (in Tesla) produced by conductors $\boldsymbol{C_1}$ and $\boldsymbol{C_2}$ respectively, while $\boldsymbol{r_1}$ and $\boldsymbol{r_2}$ are the ***CMF's*** radii in metre, $\boldsymbol{l_1}$ is the length of the conductor in metre.

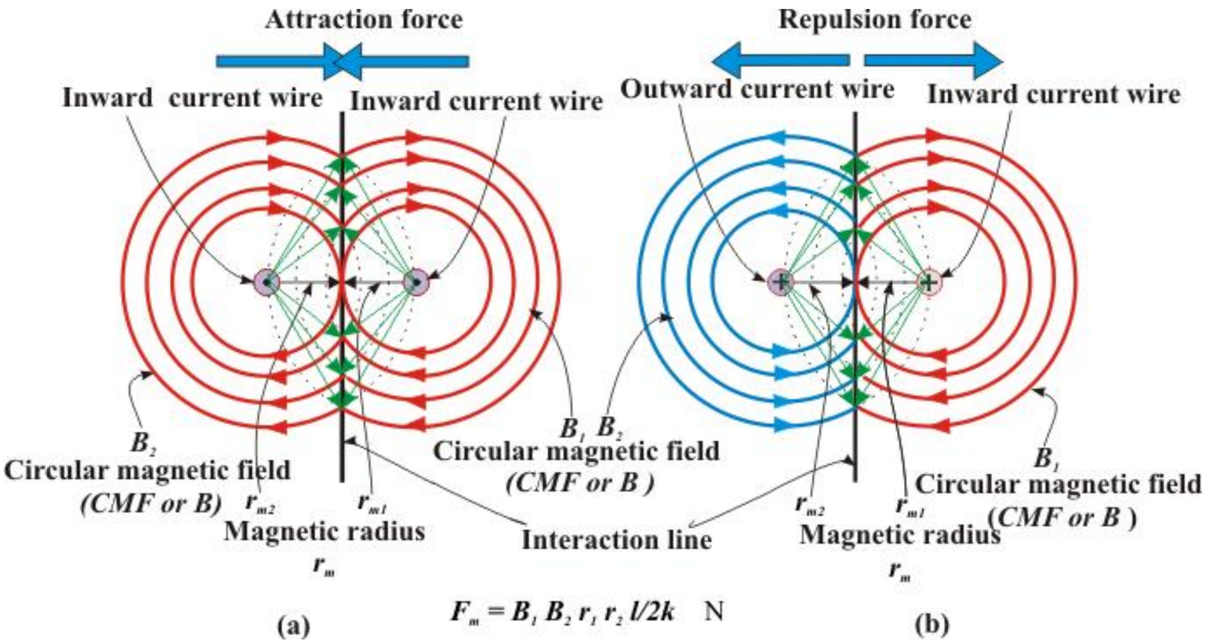


Fig.1. Production of circular magnetic field (***CMF***) [12], the figure also shows the direction of ***CMF***, the interaction line and direction of the produced force.

The Catapult force or the motor effect [12] is given by:

$$F_{e.m.} = B_1 I_1 l_2\ \ N \qquad (4)$$

Where, $\boldsymbol{B_1}$ is the magnetic field, $\boldsymbol{l_2}$ is the length of the conductor cutting the field in metre; $\boldsymbol{I_1}$

is the current in the conductor in Ampere and the magnetic force $F_{e.m}$, given by electric-magnetic parameters is in Newton.

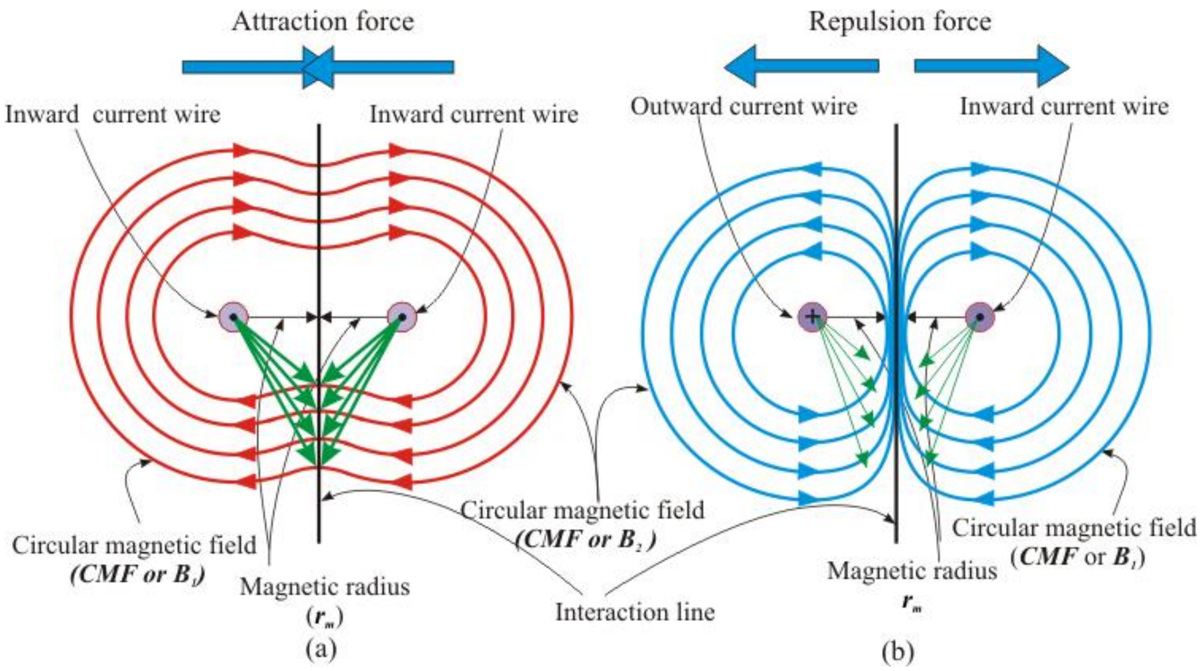


Fig .2. Cross-section views of conductors carrying electric current. Produced circular magnetic field (***CMF***) [12] interacted magnetically producing the magnetic force. Direction of both ***CMF's*** determined the direction of the force [12], in (a) it is attractive, while repulsive in (b).

The repulsive and attractive nature of magnetic lines of force causing Catapult force above, is express magnetically by

$$F_m = \frac{B_1 \, B_{c2} \, l_3 \, r_2}{2 \, k} \; N \qquad (5)$$

Where, B_1 is a general magnetic field, B_{C2} is the ***CMF*** produced by the conductor, r_2 is the radius of the ***CMF***, l_1 is the length of the conductor producing the ***CMF*** that interact with B_1, the magnetic force F_m is in Newton. Table.1. Shows the parameters relating magnetic force given by Eqs.(1), {3}, (4) and {5}.

$I_1=I_2$ A	l_1 m	D M	R M	$B_1=B_{C1}=B_{C2}$ T	$r_1=r_2=l_3$ m	$F_e=F_m=F_{e.m.}=F_m$ N
1	1	2.0	1.0	$2\text{x}10^{-7}$	0.707106781	$1.0\ \text{x}10^{-7}$
1	1	1.6	0.8	$2.5\text{x}10^{-7}$	0.632455532	$1.25\text{x}10^{-7}$
1	1	1.2	0.6	$3.333333333\text{x}10^{-7}$	0.547722557	$1.666666667\text{x}10^{-7}$
1	1	1.0	0.5	$4\text{x}10^{-7}$	0.5	$2\text{x}10^{-7}$
1	1	0.6	0.3	$6.666666667\text{x}10^{-7}$	0.387298334	$3.333333333\text{x}10^{-7}$
1	1	0.4	0.2	$1\text{x}10^{-7}$	0.316227766	$5\text{x}10^{-7}$
1	1	0.2	0.1	$2\text{x}10^{-7}$	0.223606797	$1\text{x}10^{-6}$

Table.1. Samples of parameters that gives an equivalent magnetic force in Eqs.(1), {3}, (4) and {5}, when used in its proper equation.

From both Maxwell's and Einstein's theories about magnetic field produced by charge in motion [16], it can be deduced that the magnitude of the ***CMF*** (or $\boldsymbol{B_{2e}}$ and $\boldsymbol{B_{2p}}$ for electron and proton respectively) produced by a charged particle in motion [17, 18, 19] is given by

$$B_2 = \frac{q\,v}{r_m^2\,c}\ N \qquad (6)$$

Where, $\boldsymbol{c}$ is the speed of light, $\boldsymbol{q}$ is the particle's charge in coulombs, $\boldsymbol{v}$ is the charged particles velocity in ms^{-1}, $\boldsymbol{r_m}$ is the magnetic radius at which the ***CMF*** is measured (representing $\boldsymbol{r_{me}}$ and $\boldsymbol{r_{mp}}$ or electron's and proton's magnetic radius respectively). The circular magnetic field $\boldsymbol{B_2}$ is given in Tesla.

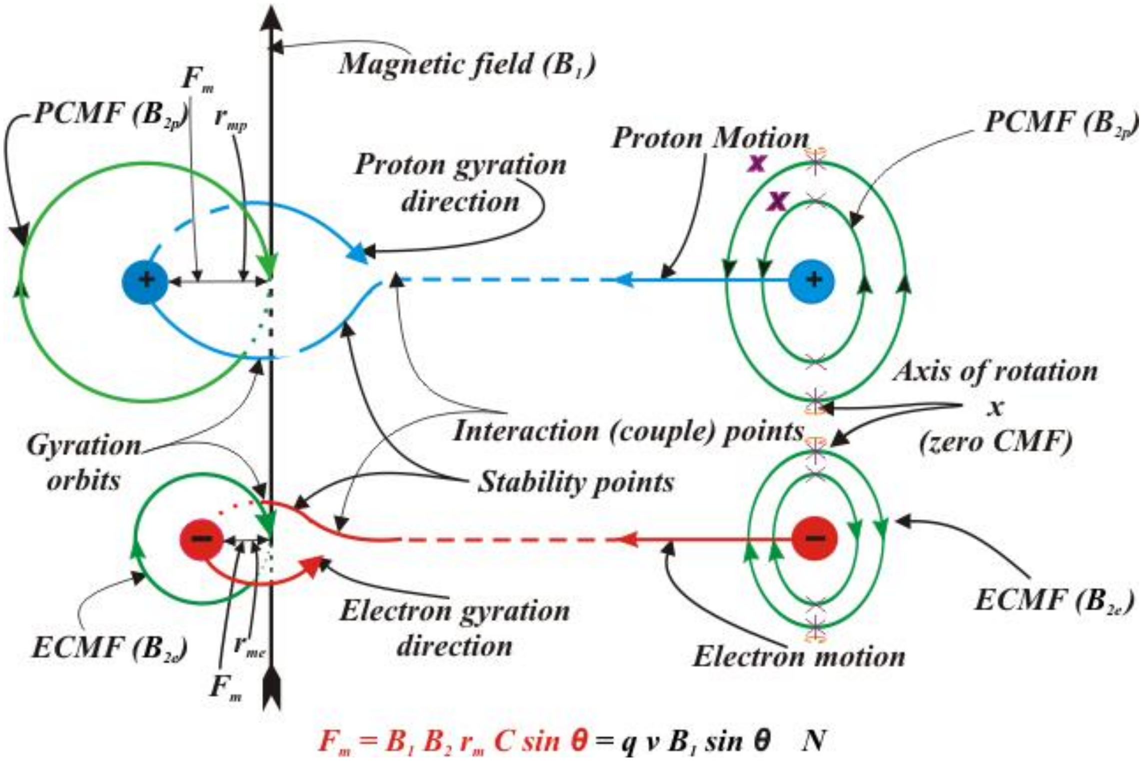


Fig.3. ***ECMF*** and ***PCMF*** [16,17,18] ($\boldsymbol{B_{2e}}$ and $\boldsymbol{B_{2p}}$ respectively) of equal energies interacted with magnetic field ($\boldsymbol{B_1}$), at specific points. Resulted magnetic force ($\boldsymbol{F_m}$) caused electron and proton to gyrate oppositely at specific radius.

$$F_{e.m.} = q\,v\,B_1 \sin\theta \quad N \qquad (7)$$

The Lorentz force ascribed to the existence of electrostatic field, used in explaining the characteristics of the magnetic force [20], while the magnetic force as associated with moving source charges is related to interaction of current bearing wire [21] shown by Eq.(1), the force is given by

Where, $\boldsymbol{\theta}$ is the angle between the trajectory and the fields. This force, is given with electric-magnetic parameters can be conceived to be caused by the magnetic interaction, where, as shown in Fig.3 the **CMF** ($\boldsymbol{B_2}$) given by Eq.(6) interact magnetically with the general magnetic field $\boldsymbol{B_1}$ such that

$$F_m = B_1\, B_2\, r_m^2\, c \sin\theta \quad N \qquad \{8\}$$

Where, θ is the angle between the two fields. While Fig.3 shows the magnetic interaction patterns between both the electron's ***CMF*** and the proton's ***CMF*** with the general magnetic field B_1, Fig.4, shows variation of F_m with r_m.

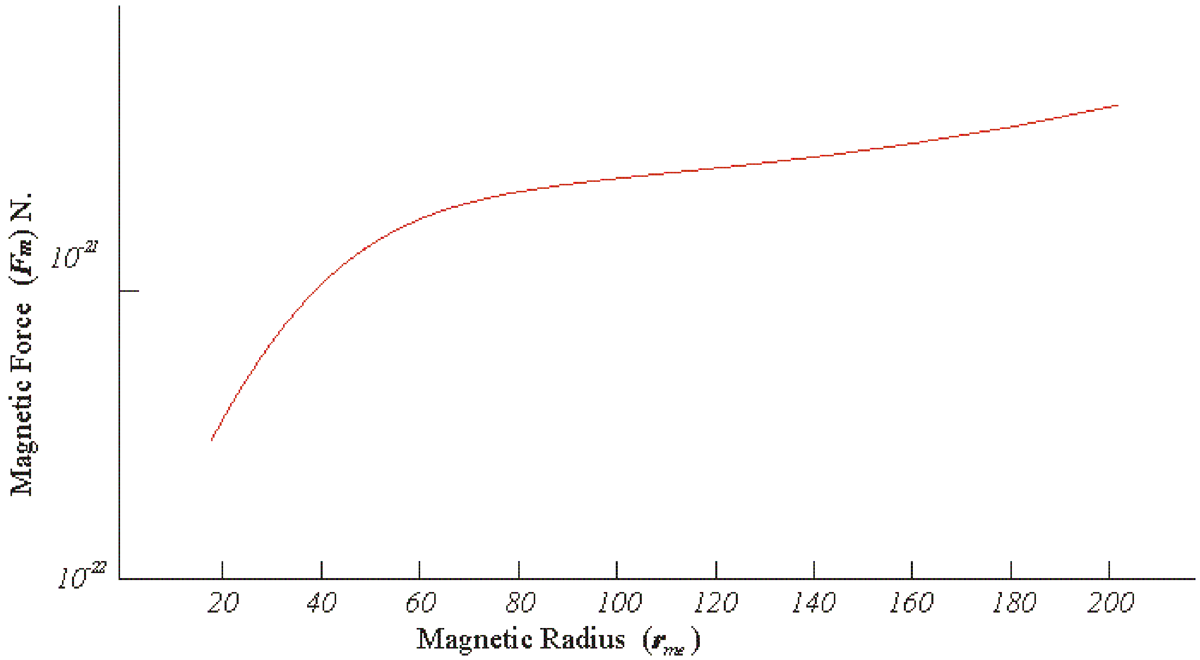


Fig4. The relationship between magnetic fore (F_m), and magnetic radius (r_{me}), for solar wind electrons of different energies, at magnetopouse boundaries at $12R_e$[31] using Eq.{8}.

2:2 THE SPINNING MAGNETIC FIELD (SMF) and NUCLEAR FORCE

2:2:1 THE SPINNING MAGNETIC FIELD

The magnetic field produced above the poles of the spinning nucleon [22] is due to total magnetic field (B_T), and is here identified as the spinning magnetic field (***SMF***). For proton, the magnitude of the total magnetic field (B_{Tp}) produced above each pole as shown in Fig.5.a, is derived from Newton's second law, Coulomb's electrostatic law and Biot-Savart law for magnetic field outside a loop [14], given by:

$$B_{TP} = B_{1P}\, r_r^2 = \frac{\mu_o\, q}{4\,\pi} \sqrt{\frac{q^2\, r_o}{\varepsilon_o\, f_{PS}\, m_P\, r_P^2}} = 1.525710414 \times 10^{-18} \quad T.m^2 \qquad \{9\}$$

Where, B_{1p} is proton's ***SMF*** (B_{1U} for nucleus hydrogen atom), f_{ps} is the proton's spinning frequency, r_O is the radial distance from proton surface to a point at which B_{TP} is produced (r_o=0.468 fm), r_r is distance from proton's surface along the magnetic field, μ_O is the permeability of the free space, ε_O is the permittivity of free space.

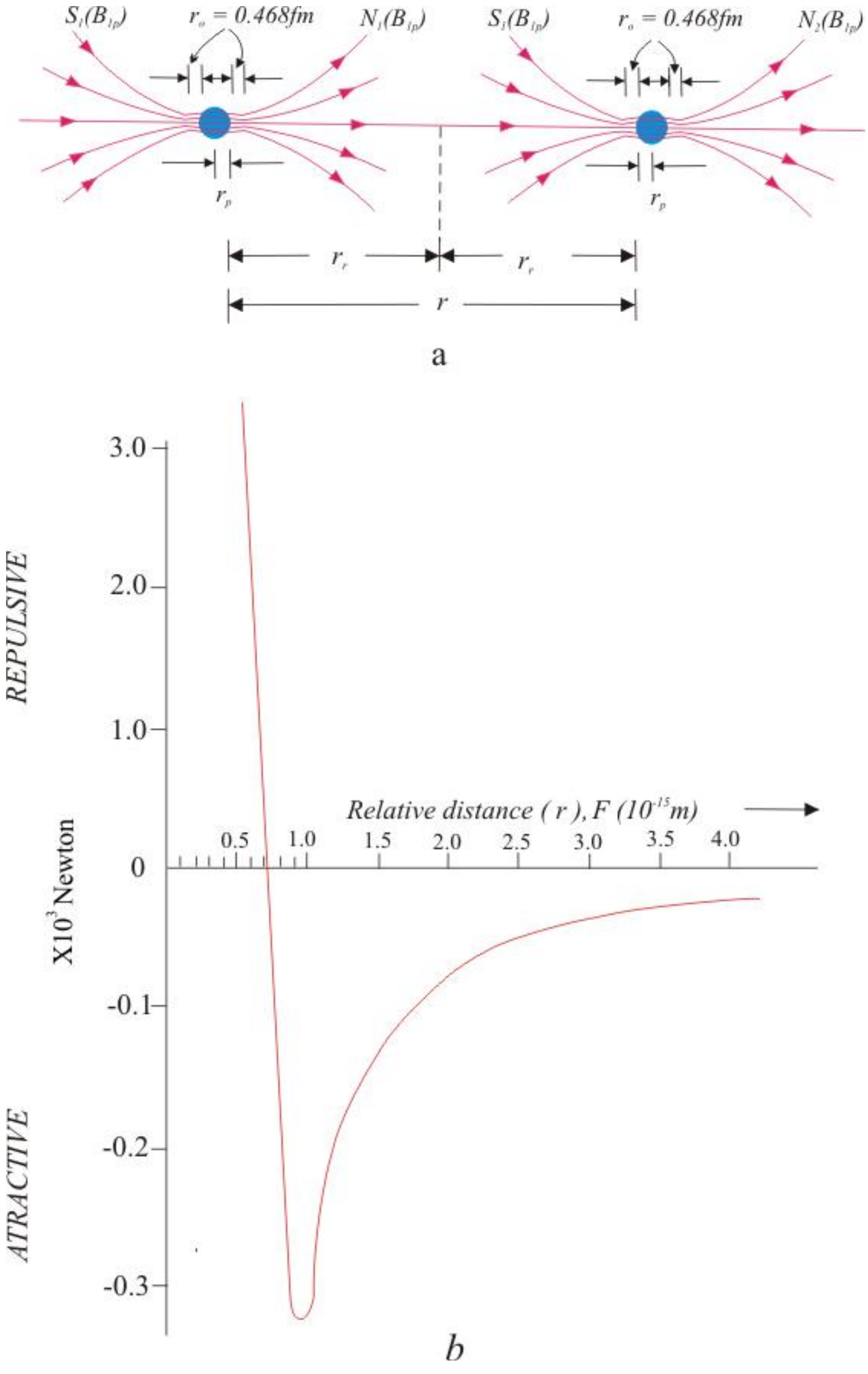


Fig.5. The proton's dipole spinning, magnetic field (***PSMF***) production [21], above the surface in (a) it also shows two ***PSMF*** interacted magnetically. In (b) attractive produced magnetic force increased exponentially till r = 0.936fm ($\boldsymbol{r_r}$ = 0.468fm) (***fm*** = 10-15 m), then the force decreased, where it becomes repulsive, due to ***PSMF*** characteristics, using Eqs. {12}, all of which showing nuclear force (***Fn***)

characteristics.

2:2:2 THE SPINNING MAGNETIC FORCE or (SMFc) THE NUCLEAR FORCE

When opposite proton's spinning magnetic field ***(PSMF)*** comes under the field influence of each other as shown in Fig.5:a, an attractive spinning magnetic force (***SMF_{CA}***) or (***F_{NA}***) is established as in Fig.5:b, and derived from Eq.{8}, this force is given by:

$$F_{NA} = \left(\frac{{B_{TP}}^2}{r_r^2}\right) c \quad N \qquad \{10\}$$

Which we here interpret as the nuclear force, In according to characteristics given [8]. The ***SMFc*** or nuclear force ***F_N*** varies as shown in Fig.5.b, whereby at relatively large distances the attraction of both ***SMF*** dominates up to ***r_r*** = 0.468fm (***r*** =0.936fm), (***fm*** = 10^{-15}) as given by Eq.{10}. Thereafter, for ***r_r*** smaller than 0.468 fm, magnitude of the ***SMF*** starts to decrease and so does ***F_{NA}*** given by the right hand part of Eq.{11}.

For smaller values than ***r_r*** = 0.468 fm, the preceding parts of the poles with similar ***SMFs*** interact with each other thus producing an ***F_{NR}*** opposing the two protons from fusing together, given by the left part of Eq.{11}. This repulsive force (***F_{NR}***) is the resultant of both two forces, as shown in Fig.5b, given by:

$$F_{RN} = \left\{n^2\left(\frac{{B_{TP}}^2}{r_o(2(r_o + r_P) - (nr_x))}\right)c\right\} - \left\{\left(\frac{{B_{TP}}^2}{((r_o + r_x) + r_o)^2}\right)c\right\} \quad N \qquad \{11\}$$

Where, ***n*** is the number of steps moved by ***SMF*** starting from r = 0.8 fm (r_r = 0.4fm), ***r_x*** is the distance moved at each step (***r*** = 0.05fm), the characteristics are shown in Fig.5.

Combining Eqs.{10} and {11}, the spinning magnetic force (***F_S***) or the nuclear force (***F_N***) is given by:

$$F_N = \left\{n^2\left(\frac{{B_{TP}}^2}{r_o(2(r_o + r_P) - (nr_x))}\right)c\right\} - \left\{\left(\frac{{B_{TP}}^2}{r_r^2}\right)c\right\} + \left\{\left(\frac{{B_{TP}}^2}{((r_o - r_x) + r_o)^2}\right)c\right\} \quad N \quad \{12\}$$

3:0 ENERGIZATION OF CHARGED PARTICLES

Assuming a system (such as that of Fig.3) if the magnetic field which is denoted by ***B_1*** is in three dimensions rotation or motion, when an electron's or proton's ***CMF*** (***B_{2e}*** and ***B_{2p}*** respectively) interacts with the ***B_1***, then the resulting magnetic force between both fields also joins the charged particles such that they all move with the magnetic field (***B_1***). Thus if the magnetic force travels a distance ***d_K*** (***d_X*** = ***d_Y*** + ***d_Z***) in unit time, then the work done is given by [23]

$$W = B_1\, B_2\, r_m^2\, c\, d_K \sin\theta \quad J \qquad \{13\}$$

Which is equal to the total (kinetic and potential) change in energy of the body acted on by the force [24] since the displacement and the magnetic force are in the same sense and direction, therefore from Eq.{13} the kinetic energy ***K*** of the charged particles is given by:

$$K = B_1\, B_2\, r_m^2\, c\, d_K \sin\theta \quad J \qquad \{14\}$$

Where, $\boldsymbol{B_1}$ is the rotating magnetic field, $\boldsymbol{B_2}$ is the ***CMF***, $\boldsymbol{r_m}$ is the radius of gyration, $\boldsymbol{\theta}$ is the angle between the two fields at interaction moment.
Fig.6, shows the relationship between different solar wind electrons velocities verses values at which it has been energized ***at microscopic level,*** at the magnetopause boundaries, where $\boldsymbol{\theta} = 90^{O}$.

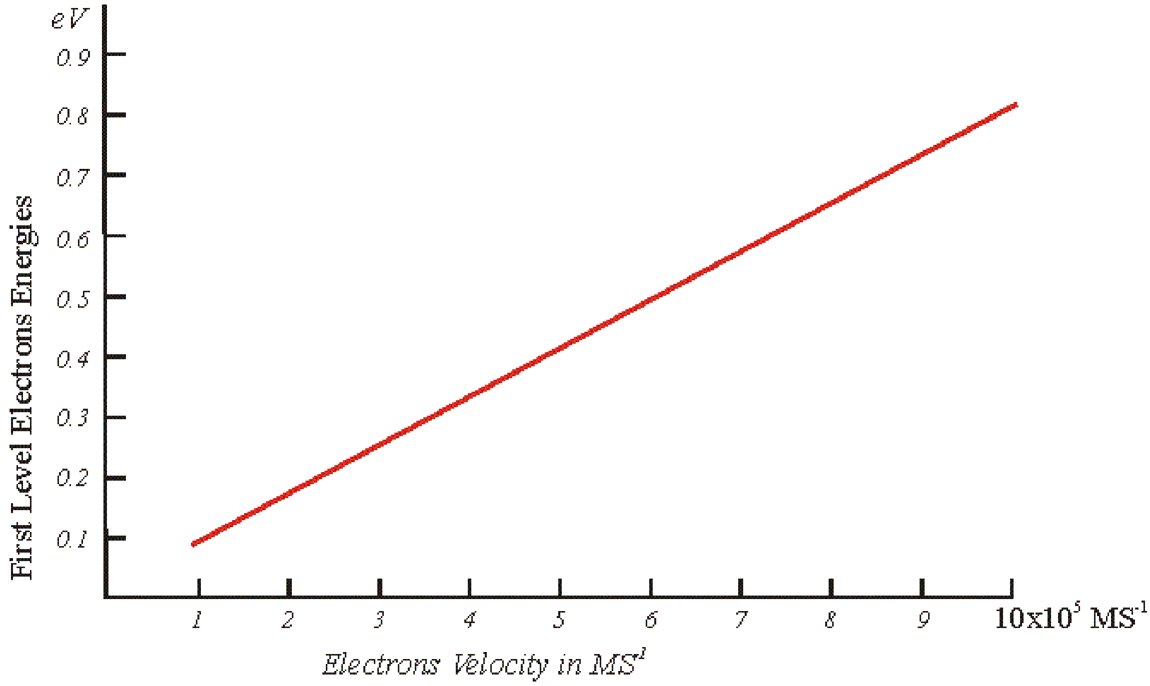


Fig.6. First level energization process verses electrons velocity, due to data shown in Fig.4.

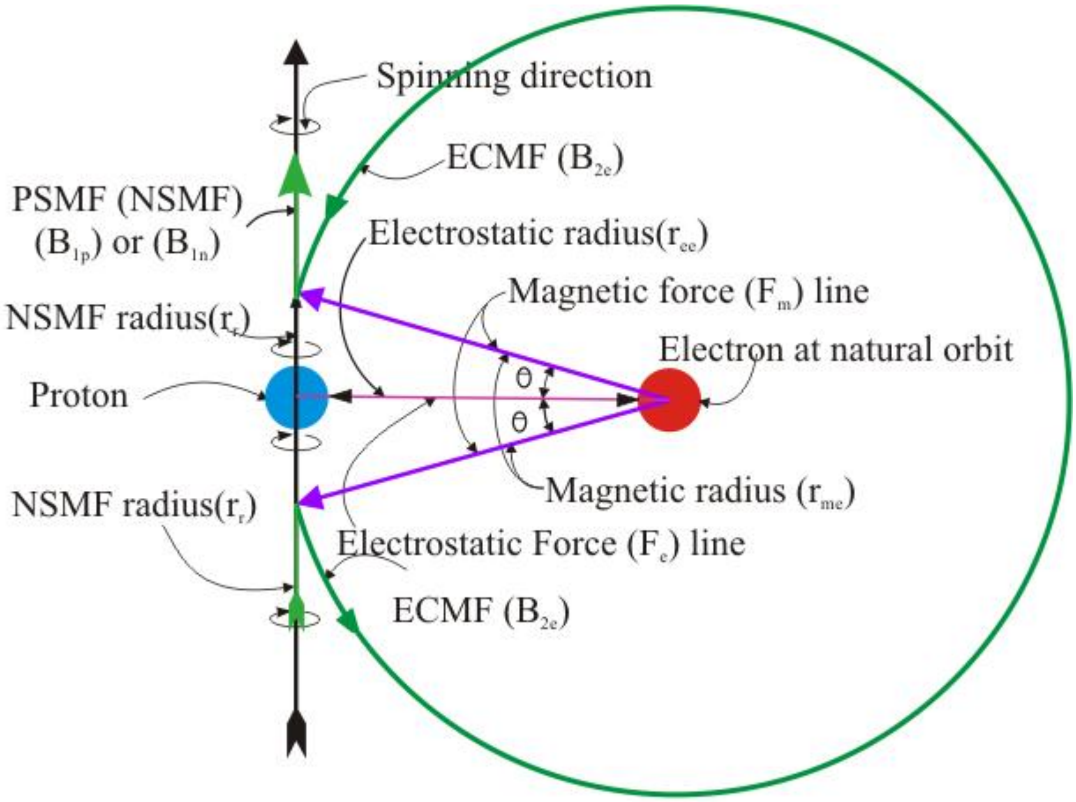
4:0 MAGNETIC INTERACTION AND ATOMIC MODEL

4:1 INTER-ATOMIC FORCES AND STABILITY

Based on this hypothesis, whenever an electron comes under the influence of a nucleus electric field at an electrostatic distance $\boldsymbol{r_e}$ the electron is accelerated by the electrostatic force such that its velocity $\boldsymbol{v_c}$ and ***CMF*** increases. Thus at a specific radius regulated by $\boldsymbol{\mu_e}$ in Eq.{26}, the electron's ***CMF*** will interact magnetically with the nucleus spin magnetic field (***NSMF***) forming an atom, or increasing the nucleus constituent. ***NSMF*** in its simplest form comprising the proton spinning magnetic field ***PSMF*** to form a hydrogen atom when interacted with electron's ***CMF.***
At specific electrostatic atomic radius $\boldsymbol{r_{ee}}$ the electrostatic force $\boldsymbol{F_e}$ is balanced with the produced magnetic force $\boldsymbol{F_m}$, and both forces are balanced with the centripetal force ($\boldsymbol{F_C}$)}, leading to the stability of the atom as shown in Fig.7, for hydrogen atom and given generally by Eq.{15} bellow, while the degree of this stability is determined by $\boldsymbol{\mu_e}$ in Eq.{26}. The balance of forces is such that

$$\{2F_c = (F_e + F_m)\} = \left\{2\left(\frac{m_e v_o^2}{r_{me}}\right)\right\} = \{(B_{1U}B_{2e}r_{me}^2\ c) + \left(\frac{Z\ e\ Q}{4\pi\varepsilon_0 r_{ee}^2}\right)\Bigg\} \quad N \qquad \{15\}$$

Where, $\boldsymbol{B_{1U}}$ is the nucleus ***SMF***, $\boldsymbol{B_{2e}}$ is orbital electron' ***CMF***, $\boldsymbol{m_e}$ is electron's mass, $\boldsymbol{r_{ee}}$ is the electron's electrostatic atomic radius, $\boldsymbol{r_{me}}$ is the electron's magnetic radius, $\boldsymbol{v_o}$ is electron's natural orbital velocity around the nucleus, ε_0 is the permittivity of the free space.



$$F_c = m_e\, v_o / r_{me} = ZeQ/4\,\pi\, € \, r_{ee} + B_{1u}\, B_{2e}\, r_{me}\, c = ZeQ/4\,\pi\, € \, r_{ee} + qv_o\, B_{1u} \quad N$$

Fig.7. Stable hydrogen atom, where Electron ***CMF*** (***B_{2e}***) interacted with Proton ***SMF*** (***B_{1p}***), then at specific magnetic radius (***r_{me}***) and electrostatic radius (***r_{ee}***), both magnetic force (***Fm***) and electrostatic force (***F_e***) are balanced with the centripetal force (***F_C***).

Since Eq.{8} represents Eq.(7), therefore the above equation becomes

$$\{2F_c = (F_e + F_m)\} = \left\{2\left(\frac{m_e v_o^2}{r_{me}}\right)\right\} = \left\{(q\; v_o\; B_{1U}) + \left(\frac{Z\; e\; Q}{4\pi\varepsilon_0 r_{ee}^2}\right)\right\} \quad N \qquad \{16\}$$

From Eq.{16}, the following is derived:

$$F_c = F_e = F_m = \left(\frac{m_e v_o^2}{r_{me}}\right) = (q\; v_o\; B_{1U}) = \left(\frac{Z\; e\; Q}{4\pi\varepsilon_0 r_{ee}^2}\right) \quad N \qquad \{17\}$$

From the balance of electrostatic and magnetic forces given by Eq.{17} above, the electrostatic orbital atomic radius ***r_{ee}*** at which an electron stabilised is given by

$$r_{ee} = \sqrt{\frac{q}{4\pi\varepsilon_0 B_{1U} v_o}} \quad m \qquad \{18\}$$

Relating Eq.{17} with angular momentum introduced by Bohr, in his atomic hypothesis [25], the electrostatic orbital radius $\boldsymbol{r_{ee}}$ is also given by

$$r_{ee} = \frac{\varepsilon_0 \, h^3}{4 \, \pi^2 m_e^2 \mu_e q} \quad m \qquad \{19\}$$

While the orbital velocity $\boldsymbol{v_O}$ could be derived from Eq.{32}, or from Bohr atomic hypothesis [25]

$$v_o = \frac{h}{2 \, \pi \, m_e \, r_{ee}} \quad m.s^{-1} \qquad \{20\}$$

Where, ***h*** is Planck's constant.

4:2 ELECTRONS' PARAMETERS AT ORBITAL RADIUS

We assumed that the stability of an atom at certain orbital radius is due to the balance of both $\boldsymbol{F_e}$ and $\boldsymbol{F_m}$ with $\boldsymbol{F_C}$, as shown in Fig.7, with parameters given in Table.2. Hence the electrostatic atomic radius $\boldsymbol{r_{ee}}$ (all of the following parameters are derived from Eq.{17}, as given in Table.2.) at orbital level take the form

$$r_{ee} = \sqrt{\left\{(B_{TP}) + \left(\frac{q}{4\pi\varepsilon_0 \, v_o}\right)\right\} \left\{\frac{q^3}{4\pi\varepsilon_0 \, m_e^2 \, v_o^3}\right\}} \quad m \qquad \{21\}$$

While the magnetic radius $\boldsymbol{r_{me}}$ (equal to Bohr radius $\boldsymbol{r_B}$) takes the form

$$r_{me} = \frac{4\pi\varepsilon_0 \, m_e \, v_o^2 \, r_{ee}^2}{q^2} = \frac{2 \, \mu_e}{q \, v_o} = r_B = \frac{\varepsilon_0 \, h^2}{\pi \, m_e q^2} \quad m \qquad \{22\}$$

Where, $\boldsymbol{r_B}$ is Bohr radius, and the ***SMF*** radius $\boldsymbol{r_r}$ is given by:

$$r_r = \sqrt{\frac{4\pi\varepsilon_0 \, v_o \, r_{ee}^2 \, B_{TP}}{q}} \quad m \qquad \{23\}$$

And the ***NSMF*** ($\boldsymbol{B_{1U}}$) or $\boldsymbol{B_{1p}}$ for hydrogen atom is given by:

$$B_{1U} = \frac{q}{4\pi\varepsilon_0 \, v_o \, r_{ee}^2} \quad T \qquad \{24\}$$

For hydrogen atom, parameters obtained due to the balance of both $\boldsymbol{F_e}$ and $\boldsymbol{F_m}$ with $\boldsymbol{F_C}$ is given in Table.2. From Eq.{22}, the electrostatic atomic radius also could be given by

$$r_{ee} = \frac{h}{4 \, \pi v_o \, m_e} \quad m \qquad \{25\}$$

4:3 THE MAGNETIC MOMENT

The flipping effect (i.e. the magnetic moment) produced in magnetic resonance experiments [9] are seen as, the response of an energetic charged particle's ***CMF*** to any specific magnetic field. For an electron in an atom, this magnetic moment ($\mu_e = E_O/B_U$) is obtained by substituting electron's orbital energy and nucleus ***SMF*** given by Eq.{24} in the following sequence

$$\mu_e = \frac{m_e\, v_o^2}{2\, B_{1U}} = \frac{2\,\pi\,\varepsilon_o\, v_o^3\, m_e\, r_{ee}^2}{q} = \mu_B = \frac{q\, v_o\, r_{me}}{2} \quad J.T^{-1} \qquad \{26\}$$

Where, B_{1U} is nucleus spinning magnetic field (***NSMF***), μ_B is Bohr magneton, μ_e is atomic electron magnetic moment related to atom stability.
Eq.{26} can be used to determine the stability orbit for both the electron's ***CMF*** and ***NSMF*** as shown in Fig.7, and numerically as in Table.2, for atomic hydrogen.

Parameters		***Magnitudes***
Electrostatic and Magnetic Forces	$F_e = F_m$	$8.257749961 \times 10^{-8}$ N
Inter-Atomic Forces	$2F_c = F_e + F_m$	$1.6515499922 \times 10^{-7}$ N
Electrostatic Atomic Radius	r_{ee}	$0.528566407 \times 10^{-10}$ m
Magnetic Radius	$r_{me} = r_B$	$0.5291793603 \times 10^{-10}$ m
Stable Orbital Velocity	V_O	2190219.655 $m.s^{-1}$
SMF radius	r_r	$2.546269208 \times 10^{-12}$ m
NSMF	B_{1U}	235322.5112 T
Electron's SMF	B_{2e}	0.417706473 T
Magnetic Moment	μ_e	$9.284770122 \times 10^{-24}$ J/T

Table.2. Electron's parameters at natural orbit in for hydrogen atom. This Table should be read in connection with Fig.7, and Eqs.{16, 18, 19, 20, 21, 22, 23, 24, 25, 26, and 31}.

5:0 INTER-ATOMIC ENERGIZATION and the REPRODUCTION of SPECTRAL LINE

From the magnetic interaction hypothesis based on Eqs.{8}, {13} and {14}, any electron gyrating at its natural orbit in an atom under the influence of the spinning magnetic force, continually undergoes an energization process so that it acquires an amount of orbital energy

$$E_o = \frac{r_{me} q\, v_o B_{1U}}{2} \quad J \qquad \{27\}$$

With reference to Fig.8, whenever such an electron is subjected to an excitation potential, both its kinetic energy and the ***CMF*** (B_{2e}) increases and hence the magnetic force increases as well. This force increases the orbital radius so that the radial energy change is obtained as

$$E_n = \frac{r_n q\, v_D B_{1U}}{2} \quad J \qquad \{28\}$$

Where, v_D is the excitation velocity, r_n is the excited orbital radius. The quanta of energy acquired by the electron at that radius will be radiated as an electromagnetic radiation, the sequence of which is shown in Table,3, with the wavelength given by

$$\lambda = \frac{2\,h\,c}{r_n\,q\,v_D B_{1U}} \quad Å \qquad \{29\}$$

From Eqs.{18} and {27}, the general excitation energy at any radial distance within the atomic excitation range becomes

$$E_n = \frac{m_e\,v_n\,v_D}{2} \quad J \qquad \{30\}$$

Where, $\boldsymbol{v_n} = \boldsymbol{v_D} + \boldsymbol{v_O}$, i.e. the excited radial velocity.

E_D Ve	V_n m.s	B_{2n} T	F_n $x10^{-7}$ N	r_n $x10^{-11}$ m	F_r $x10^{-8}$ N	E_n Ve	λ Å
5.0	3516424 .623	0.670632 8886	1.32579 1924	8.49603 9785	5.00016 9275	13.25747 0411	0935.850 3044
3.399 525	3283759 .893	0.626260 367	1.23807 0714	7.93389 8117	4.12295 7183	10.20833 388	1215.380 283
1.0	2783316 .547	0.530818 604	1.04938 9364	6.72477 6059	2.23614 3679	4.692853 031	2643.809 136

Table.3. Samples of sequences through which an excited electron in hydrogen atom transverse, before radiating specific wavelength using Eq.{28}, as shown in Fig.8.

Thus the radiated wavelength λ due to such a specific energy quantum (an example of which is shown in Table.4, to be compared with Table.3.) is given by

$$\lambda = \frac{2\,h\,c}{m_e\,v_n\,v_D} \quad Å \qquad \{31\}$$

Hence,

$$v_O = \frac{2\,h\,c}{m_e\,v_D\,\lambda} - v_D \quad m.s^{-1} \qquad \{32\}$$

No	E_D Ve	V_n m.s	λ Å
1	5.0	3516424.623	0935.8503044
2	3.399525	3283759.893	1215.380284
3	1.0	2783316.547	2643.809137

Table.4 Reproduction of spectral lines by excited electrons, using Eq.{31} and Eq.{32}, reducing steps used in Table.3.

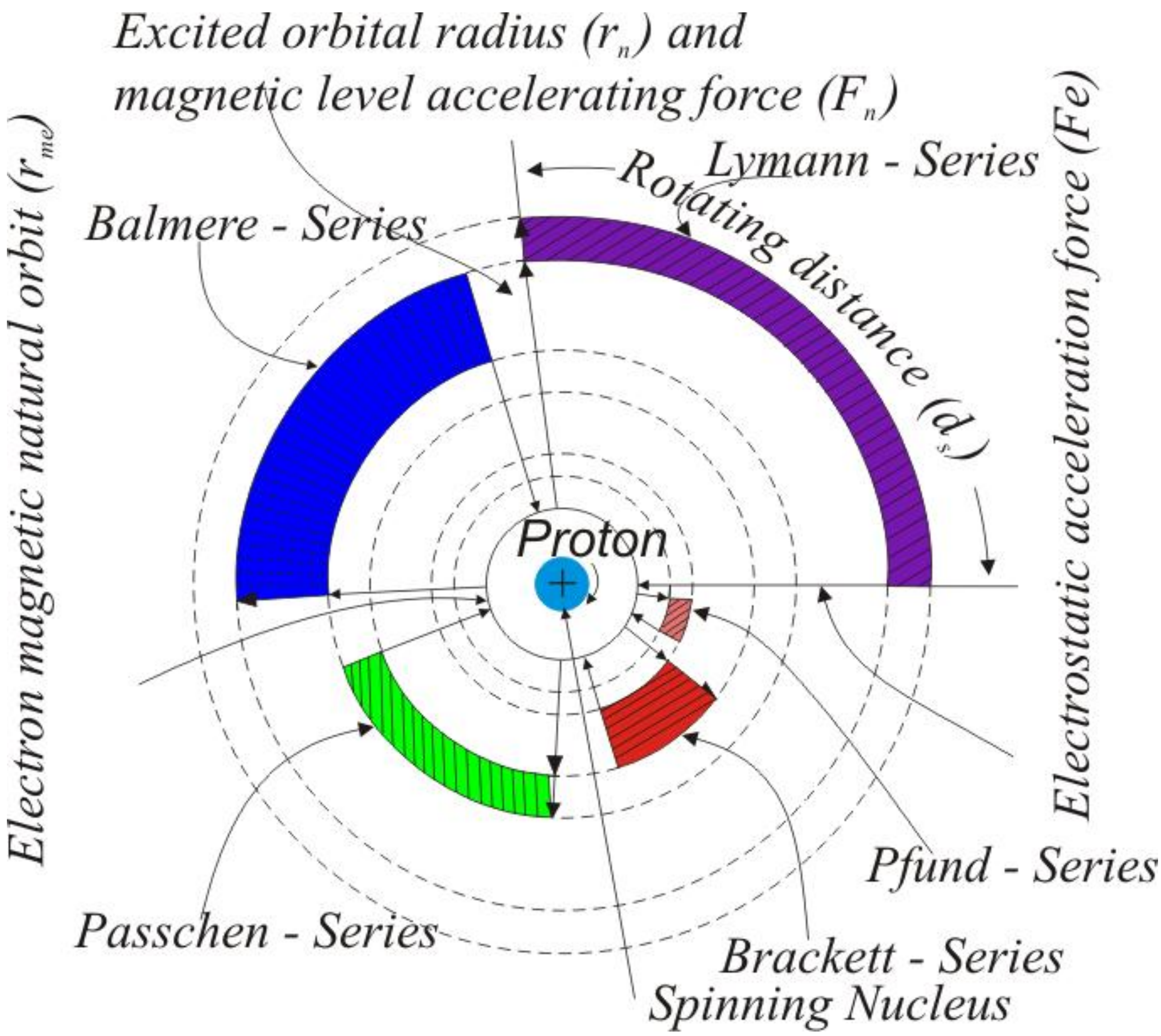


Fig.8. Spectral line sequential reproduction for hydrogen atom. Each quanta of series energy is due to multiplication of both the magnetic level accelerating force (***Fn***) by the spinning distance (***ds***). After radiating the quanta of energy, electron is accelerated back to the natural orbit by Fee.

6:0 DISCUSSIONS

1- Although magnetic fields are produced due to relative motion of charged particles, the direct cause of the magnetic force is here considered to result from the interaction of magnetic fields. This interaction explains the mechanism behind the attractive and the repulsive forces between any two wires carrying electric currents as shown in Fig.2. It also explains the orbital excitation energy characteristics for charged particles and why the direction gyration of an electron is opposite to that of a proton, as shown in Fig.3.

2- The exponential nature of Fig.5 is due to the production of spinning magnetic fields, and above proton's surface (r = 0.468fm) as proved for neutron's ***SMF*** [26], compared with Fig.4.

3- The exact measured magnitude of the nuclear force for the proton is determined by the magnitude of produced B_{Tp} given by Eq.{9}. In this case it is related to the magnetic moment value. Since the value of the proton's angular frequency (ω_p) has been determined as 0.5 rad. sec. (i.e. from Eqs.{26},{27},{28},{29},{30}, and {31}), therefore its spinning frequency (f_{ps}) is of the magnitude of 0.079577471 s^{-1}, from which B_{Tp} is derived.

4- The ***CMF*** interaction with the magnetic field (B_1) is represented in Fig.3. The same mechanism occurred inside an atom where the balance of both the F_e and F_m with F_C at specific r_{ee} and r_{me} brings stability to the atom, as shown in Fig.7.

5- The nature of the magnetic interaction is that, the weaker ***CMF*** (B_2) interacts with the stronger magnetic field (B_1) at two specific points. These two points arise due to the variation in the strength of B_{1p} as shown in Fig.7, for hydrogen atom.

6- From Eqs.{18}, {20} and {24}, the value of r_{ee} include proton's radius r_p, and electron's radius r_e. Both are thought to be equal, and derived from Eq.{9}.

7- The Bohr radius (r_B), giving in the right hand side of Eq.{22}, is resulted from the balance of both the Coulomb's electrostatic and centripetal forces, (with value of $0.5291793603\text{x}10^{-10}$ m) [27, 28], it gives the same value given by the magnetic radius (r_{me}), therefore both are equal and given by Eq.{22} and shown in Table.2.

8- The known value for electron's orbital angular momentum (L_o) [29] is $1.054\text{x}10^{-34}$ kg.m^{2}s^{-1}. While the value obtained from Table.2, parameters are $1.054572669\text{x}10^{-34}$ kg.m^{2}s^{-1} using r_{ee}.

9- Electron's magnetic moment μ_e = $9.284770119\text{x}10^{-24}$ j/T obtained from multiplication of Bohr magneton (μ_B) [30] by 1.001159652193 as verified by experiments [22, 31], is obtained with the same value using any of Eq.{26}, thus Bohr magneton (μ_B) gives correct magnetic moment value when using correct parameters (v_O and r_{me}).

10- The electrostatic radius, r_{ee} which determined v_o, F_e, r_{me}, r_r, and B_{1U} is derived by Eq.{19} using (μ_e and h), or Eq.{21}, or Eq.{25}, all of which give the value of $0.528566407\text{x}10^{-10}$m, and given in Table.2.

11- The v_o is derived either from Planck's relation Eq.{20} or the radiated spectral line, given by Eq.{32}.

12- The known proton's radius (r_p) [22], is $1\text{x}10^{-15}$ m, while from Eq.{9}, r_p=$1.1060236231\text{x}10^{-15}$ m.

13- The excitation energy (E_D) is relative to the ionisation energy [27, 28], for hydrogen atom the ionisation energy, used in Eqs. {27},{28},{29} {30} and{31} is 13.5981 eV [26].

14- For any atom if both the radiated wavelength λ and the excitation velocity v_D is known then the ***electron's natural orbital velocity v_o (at natural orbital radius)*** can be obtained using Eqs.{20} or {32}.

15- With reference to two points above, atomic spectral lines can be reproduced as shown in Fig.8. While Table.3, shows the reproduction sequential mechanism, and Table.4, summarised all of Table.3, using only Eq.{31}, both tables gives the same results.

16- Energy changes for charged particles therefore take the following two forms:

(a) The normal work done due to the displacement of the magnetic force from the normal orbital radius (r_{me}) to the excitation orbital radius (r_n) inside an atom, the energy of which is radiated, as shown in Fig.8.

(b)Starting from the single particle ***micro-level,*** energy as given by Eq.{14} and shown in Fig.6, electrons and protons can proceed to higher radial energy, due to the produced external magnetic field (***ExMF***). The several steps of energization may lead to acceleration mechanisms, such as those found in the magnetopause boundary in the transition region [3, 32], both aurora oval [6], and stable aurora red arc system (SAR-arc) [33], radiation belts [3], and the ring current's [6] comprising charged particles.

17- From Fig.5:b. The degree of stability for two nucleons depends on the equilibrium distance, where attraction and repulsion forces are balanced, similar to forces between two atoms [34]. Relative unbalance of the nuclear force magnitude causes the vibration (or oscillation) motion of both nucleons (around 0.7 Fm, as shown in Fig.5.b.). Similar to the molecule's vibration motion of the spring form, associated with energy [35, 36]. Larger nucleus B_{TU} magnitudes, give higher oscillations and lower nucleus nuclear stability, with the associated energy and consequently leading to decay processes.

18- From point (15), the smallest excitation potential of 1.982807168x10^{-3} eV can reproduce Pfund series of 74599.21569Å in hydrogen atom. This therefore reveals the precision of all natural phenomena mechanisms.

19- The 1922, silver atoms beam experiment carried out by Otto Stern and Walther Gerlach, where the beam split into two sub-beams on the detecting plate by the action of the electromagnetic field [29].

The experiment is re-interpreted as:

(a) While in motion, the silver atom ***NSMF*** foreheads consist of both ***NSMF***.

(b) In uniform field, each forward ***NSMF*** detected the field as relatively equal magnitude of $\boldsymbol{B}$.

Thus $\boldsymbol{F = (B_1)\ (B_{2N})\ r^2\ c}$, gives net $\boldsymbol{F = 0}$.

(c) In no uniform field, each of the ***NSMF*** interacted as follow:

-NSMF is attracted upward by $\boldsymbol{-F = (+B_1)\ (-B_{2U})\ r^2\ c}$.

+NSMF is repelled downward by $\boldsymbol{+F = (+B_1)\ (+B_{2U})\ r^2\ c}$.

Therefore the silver atoms formed split on the detected glass.

20- The measured nuclear force between two protons which is $(45)^2$ times greater than the electric force [8], is re-interpreted as kinetic energy phase of great accelerated nucleons.

21- The ***MIH*** open the door for several new ideas in many fields.

22- Physical constant used, are:

q = 1.60217733x10^{-19} C.

m_e = 9.1093897x10^{-31} kg.

m_p = 1.6726231x10^{-27} kg.

h = 6.6260755x10^{-34} J.s [12].

ε_O = 8.854223x10^{-12} $C^2.N^{-1}.m^{-2}$ [37].

ACKNOWLEDGEMENT

My gratitude to my sister Sophya and her husband Abubakar Mohamad and children for their hospitality. The Chairman of Physics Department, University of Nairobi, Prof. B.O. Kola for providing the scientific umbrella, and Dr John Buers Awuor and Dr Lino Gwaki in the Physics Department without whom this work could not have taken the present form. Late Leader Yousif Kuwa Makki, for his moral supports, The late Dr. Tajudeen Abdul-Raheem, the stuff of Nuba Relief Rehabilitation and Development Organization (NRRDO), particularly Mr Ali Abdulrahman , Amar Amon and Jacob Idriss. Brothers and sisters, Mustafa, Mahamad, Halima, Hukmalla, Arafa, Asha, Ahmad and Esmaeil. Finally, Dr Ali Khogali, Prof.John O. Owino, Dr C. Oludha, Dr P. Baki, Shiekh-Eldien Mousa, Katoo T. Nzivo, Chiromo Library Stuff, Kenya National Library and University of Makerery Library (Uganda).

7:0 Glossaries

$\boldsymbol{B_1}$: Magnetic field

$\boldsymbol{B_{1U}}$: Nucleus spinning magnetic field (***NSMF***)

$\boldsymbol{B_2}$: The ***CMF***

$\boldsymbol{B_{2e}}$: Electron's ***CMF***.

$\boldsymbol{B_{2e}}$: Orbital electron' ***CMF***

$\boldsymbol{B_{2p}}$: Proton's ***CMF***.

B_T: Total Magnetic Field.
B_{Tp}: Proton's total magnetic field.
CMF: Circular magnetic field.
d_K ($d_X = d_Y + d_Z$): Energization distance travels by magnetic force.
ExMF: External Magnetic Field.
F_C: Centripetal force.
F_e: Electrostatic force.
F_m: Magnetic force.
f_{ps}: Proton's Spinning frequency.
h: Planck's constant.
K: Kinetic energy of charged particles.
L_o: Electron's orbital angular momentum.
m_e: Electron's mass.
MIH: Magnetic Interaction Hypothesis.
NSMF: Nucleus spinning magnetic field.
PSMF: Proton's Spinning Magnetic Field**.**
r_B: Bohr radius.
r_{ee}: Electron's electrostatic atomic radius.
r_m: Magnetic radius of gyration.
r_{me}: Electron's magnetic radius (equivalent of Bohr radius).
r_n: Excitation orbital radius.
r_r: ***SMF*** radius.
SMF: Spinning magnetic field.
SMF_{CA}: Attractive spinning magnetic force.
v_c: Charged particles velocity.
v_o: Electron's natural orbital velocity around the nucleus.
$v_n = v_D + v_O$: The excited radial velocity.
ε_O: Permittivity of the free space.
θ: Angle between two fields at interaction moment.
λ: Wavelength.
μ_B: Bohr magneton.
μ_e: Atomic electron magnetic moment related to atom stability.
ω_p: Proton's angular frequency.

8:0 REFERENCE

[1] Lehnert B. 1964 Dynamics of Charged Particles, North- Holland Publication co. Amsterdam, pp 1.
[2] Chapman, S. 1967 (Perspective) Physics of Geomagnetic Phenomena Vol.I, Edt. By S. Matsushita and Wallace H. Campbell, Academic Press, New York.
[3] Kern, J. W. 1967 (Magnetosphere and Radiation Belt), Physics of Geomagnetic Phenomena, Vol.II, Edt. By S. Matsushita and Wallace H. Campbell, Academic Press, N. Y, pp 1044-1097.
[4] Matsushita S. 1967 (Geomagnetic Disturbances and Storms) Physics of Geomagnetic Phenomena, Vol.II, Edt. By S. Matsushita and Wallace H. Campbell, Academic Press, N. Y, pp 811.
[5] Axford, W.I. 1967 (The Interaction Between the Solar Wind and The Magnetosphere) AURORA AND AIRGLOW, Proceeding of the NATO Advanced Study Institute held at The University Of Keele, Staffordshire, England August 15-26,1966, Edt. By Billy M. McCormac, Reinhold Book Cor. New York, pp 1273/1282.

[6] Akasofu, S.I. and S. Chapman 1967 (Geomagnetic Storms and Auroras), Physics of Geomagnetic Phenomena, Edt. by S. Matsushita and Wallace H. Campbell, Vo.II, Academic Press,N.Y, pp 1119-1133.
[7] Chapman S. 1968 (Auroral Science, 1600 To 1965, Towards its Golden Age), Auroral Science, Atmospheric Emission, NATO Advanced Study Institute, Norway, Edt. By Billy M. McCormac, Reinhold Book Cor. New York, pp 25.
[8] Davis, P.C.W. 1979 The Forces of Nature, Cambridge University Press, Cambridge, pp 133.
[9] Elwell D. and A.J. 1978 Pointon Physics for Engineers and Scientists, Ellis Horwood Ltd. Chester, pp 313-317.
[10] Bengt Hultqvist 1967 (Aurora), Physics of Geomagnetic Phenomena, Edt. by S. Matsushita and Wallace H. Campbell, Vo.II, Academic Press, N.Y.
[11] The Report of The National Commission on Space 1986 Pioneering The Space Frontier, Bantom Books, New York pp 25-29.
[12] Trinklein, F. E. 1990 Modern Physics, Holt, Rinehart and Winston, N.Y), pp 479.
[13] Yousif, Mahmoud E. "The Magnetic Interaction", at: http://www.journaloftheoretics.comLinks/Papers/MY.pdf 09-Oct-2003a.
[14] D. S. Parasnis 1961 Magnetism From Load Stone To Polar Wendering, Hutchinson & Co. Ltd. London.
[15] Nightingale E., 1958 Magnetism and Electricity, G. Bell and Sons Ltd. London, pp 16.
[16] Butler, S.T. and H. MESSEL 1963 The Universe of Time and Space, Pargman Press, London, pp 185-191.
[17] Alonso M. and E. J. Finn 1967 Fundamental University Physics Vol. II Field and Waves, Addison and Wesley, Massachusetts, pp 530.
[18] Ballif, J.R. 1969Conceptual Physics, John Wiley & Sons, New York, pp 338.
[19] Fuch, W. R. 1967 Modern Physics, Weidenfield and Nicolson (Educational) Ltd., and The Macmillan for Translation, Zurich.
[20] Plonsey, R. and R. E. Collin 1961 Principle Applications of Electromagnetic Fields, Tata McGraw-Hill Publ. Cop. Ltd. New Delhi.
[21] French, A.P. 1968 Special relativity, Nelson, Sunbury, UK, pp 334.
[22] Halliday, D., R. Resnick and K. S. Krane 1978 Physics Vol.II, John Wiley & Sons, New York, pp 813.
[23] Avison,J. 1989 The World of Physics, Nelson, Ontario, pp 107.
[24] Encyclopaedic Dictionary of Physics 1961 J.Tewlis, Pergamon Press, Frankfort, pp 271.
[25] Martindala, G. David, Robert W. Heath, Philip C. Eastman 1986 Fundamental of Physics, Heath Canada Ltd.
[26] McGraw-Hill Encyclopaedia of Science and Technology 1982 5th edition, Vol.14, McGraw-Hill Book Co., New York, pp 740.
[27] Krane K. S. 1983 Modern Physics John Wiley & Sons, New York, pp 164, 165.
[28] Giancoli, D. C. 1980 General Physics, Prentice-Hall Inc., Englewood Cliff, New Jersey.
[29] Swartz, C. E. 1981 Phenomenal Physics, John Wiley and Sons, N.Y.
[30] Halliday, D. and R. Resnick 1986 Modern Physics Chapter for Physics third edition, John Wiley & Sons, New York, pp 1175, 1181-1185.
[31] Halliday, D. and R. Resnick 1988 Fundamentals of Physics, John Wiley & Sons Inc., N.Y.
[32] Heppner J.P. 1967 (Satellite and Rocket Observations) Physics of Geomagnetic Phenomena, Vol.II, Edt. By S. Matsushita and Wallace H. Campbell, Academic Press, New York, pp 1005-1003.
[33] Cole K. D. 1967 the D Main Phase and Certain Associated Phenomena), Physics of

Geomagnetic Phenomena, Vol.II, Edt. By S. Matsushita and Wallace H. Campbell, Academic Press, New York, pp 1312.
[34] Freeman, I. M. 1968 Physics: Principles and Insights, McGraw-Hill Book Co., New York, pp 55.
[35] Toon E. R. and G. L. Ellis 1973 Foundation of Chemistry, Holt, Rinehart and Winston Ltd, NY, pp353-356.
[36] Oxtoby David W. and Nachtrieb Norman H. 1991 Principle of Modern Chemistry (Study Guide and Student Solutions Manuales), Saunders College Publishing, Philadelphia pp 581.
[37] Tuma, Jan J. 1979 Engineering Mathematics Handbook, McGraw-Hill Book Company, New York

Published by:
EXMF-PS
http://exmfpropulsions.com/