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The Compton Effect Re-Visited

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Abstract

The Primary Electromagnetic Radiation (P-EM-R) is suggested to interact with inter-atomic electron during Compton Effect phenomena, producing Radiation Magnetic Force (F_{mR}) moving electron to higher binding Energy, where an increased in Total Circular Magnetic Field (B_{CMFT}) automatically formed electron Forced Binding Energy (E_{bFE}) and Secondary Radiation Energy (E_s); the E_{bFE} is added to the related Orbit Binding Energy (E_{b-n}) constituting Electron's Kinetic Energy (E_k), while E_s is transformed into Secondary Electromagnetic Radiation (S-EM-R) through the Flip-Flop (F-F) mechanism, characterized by relativistic mass/velocity frequency and angle ϕ_1 controlled, ended with increased S-EM-R wavelength releases at angle ϕ; a recoil force resulted from S-EM-R releases, ejecting electron at an angle θ, the force is added to E_{bFE} to form electron's energy (E_e); the E_s is also related to x-ray process of production from energetic electron impinging anode in an x-rays tube; the paper accommodates Compton formulas except the momentum photon; the paper is aimed at improving our understanding to the physical reality.

Keywords: Compton Effect; Generation of secondary electromagnetic radiation; X-ray production; Circular magnetic field; Electron binding energy; Atomic structure.

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1. INTRODUCTION

Compton stated in 1923, that "*scattering is a quantum phenomenon; and a radiation quantum carries with it momentum as well as energy*"[1], after trial with classical solution till end of 1922[2], the interpretation consolidated Einstein 1905 photoelectric effect[3], rejected by leading contemporary scientists[4], while Bohr tried a different model[5]; but Compton's formula and experimental verification, changed destiny of Einstein's quantum model[6].

Compton believed in the universal validity of classical electrodynamics[2], neither motivated nor influenced by Einstein's 1905 light-quantum hypothesis[7], only shifted to quantum after six years in classical physics[2], implying he may have known about Einstein light-quantum. However, the quantum theory of scattering only applied to light elements[8], and failed to resolve the heavy atoms, where recoil energy is smaller than the binding energy of scattering electron[9], and CE was contested with a classical model[10], in addition to discovery that Radiation Magnetic Force (F_{mR}) embedded Electromagnetic Radiation (EM-R), similar to Planck' Energy (E_{mR})[11], casting doubt on photon existence and necessitate revision of CE.

At his era, Compton interpretation necessitate billiard-ball of quanta, a situation expressed by Raman that "*the classical wave-principles are not easily reconcilable with Compton effect because they have not been correctly interpreted*,"[10], that shortage resulted from lack of understanding to nature of magnetism and magnetic force, where a formula expressing interaction between charged particle magnetic field with stationary magnetic fields give same force but different mechanism[12], the spinning magnetic field, and spinning magnetic force deduced fields magnitudes and formulas for each charged particle and their interaction with each other[13], helped in forming atomic model in which the force by both the magnetic force produced by revolving electron and nucleus, and the electrostatic field are balanced with the centripetal force[11, 12], all of which suggested the Electromagnetic Radiation (EM-R) to be produced through the Flip-Flop (F-F) mechanism, of both the Circular Magnetic Field (CMF) and the Electric Field (EF) of charged particles[14], rather than charged acceleration[15]; the Flip-Flop (F-F) mechanism showed EM-R energy to be concentrated in the magnetic field as twisted CMF, all of which gives the condition initiating EM-R production and nature of Planck' Constant (*h*)[16], helped in re-explaining the photoelectric effect by deriving the Radiation Magnetic Force (F_{mR}) embedded in EM-R similarly to Planck' energy formula, the F_{mR} expels electron from the atom, rather than the quanta (photon), it also disclosed the origin of Planck' constant[11].

Using these as a bases, this paper re-investigated the Compton Effect and suggested the interaction of x-ray and γ-rays Primary Electromagnetic Radiation (P-EM-R) with inter-atomic electron, as a phenomenon in which the embedded Radiation Magnetic Force (F_{mR}), moved electron towards the nucleus at the Force Binding Energy (E_{bFE}) orbit, where the total produced CMF (B_{CMFT}) interacted with nucleus Spinning Magnetic Field (B_{1U}), distributing the B_{CMFT} energy into Forced Binding Energy (E_{bFE}) and Secondary Radiation Energy (E_s), the E_s is transformed into Secondary Electromagnetic Radiation (S-EM-R) through the Flip-Flop (F-F) mechanism, during which electron's relativistic mass and velocity are controlled by frequency and angle ϕ_1, S-EM-R is released at angle ϕ, afterward the recoil force ejected electron at angle θ. A relation is established between electrons energized by P-EM-R and x-rays electrons accelerated in x-ray machine[17], it suggested both to radiate E_s as S-EM-R. The method used is based on creating a model from the ambiguous characteristics of the *CMF*, then compared and testing the results with reproducible derived data, given in Tables 1, 2, 3 and Figures 1 and 2.

Eighty seven years ago, Raman stated that "*the classical wave-principles are not easily reconcilable with Compton effect because they have not been correctly interpreted*," he then asked "*What would be the nature of the secondary radiation emitted by the atom*?" [10], the correct interpretation of magnetic field relation with atom, and the generation of electromagnetic radiation helped in this explanation. This raised a question, of whether some concepts (such as Compton Effects) are *scientific truth*, and if so how a *scientific truth* can be *accepted to become a final truth?*[18], particularly when it imposed such decisive conclusion which diverted the course of the physical science to such mathematical structure; while this reinterpretation illustrates the phenomena as an amazing outstanding natural mechanism; therefore, it is hoped that, this explanation which also strengthened inter-atoms mechanism knowledge, would restore sense of sanity within the scientific arena, and may lead to a better understanding to the inner mechanism of nature, and reduce inefficiency in x-ray generation [17] among others, reflecting positively on future energy crises and technological developments on this planet and in the space, and to form a better understanding to our status in the Universe based on accurate scientific knowledge.

2. The Interaction of Radiation Force and Energy with Inter-atomic Electron

The interaction of x-ray, and γ-rays Prime Electromagnetic Radiation (P-EM-R) in Compton Effects, with inter-atomic electrons, forced electron to high binding energy orbit shown in Figure 1, and given in Table 1, the force is expressed by[11]

$$F_{mR} = (B_{1U} B_{2e} r_m^2 c) + \left(\sqrt{y\nu^3}\right) = F_{CA-n} \gg F_O \qquad (1)$$

Where, B_{1U} is the strong magnetic field or nucleus Spinning Magnetic Field (*SMF*) in Tesla, B_{2e} is the Circular Magnetic Field (*CMF or* B_{CMF}) produced by orbital electron in Tesla, r_m is the magnetic radius in meter, *c* is the velocity of light in m.s^{-1}, ν is the Prime Electromagnetic Radiation (P-EM-R) Frequency in Hz, y is the constant of radiation force with magnitude equal 1.906318161436107200999849625463×10^{-61} N^2. Hz^{-3} (or N^2.s^3.), F_O is threshold Force, F_{CA-n} is Compton Effect Force and F_{mR} is the Radiation Magnetic Force.

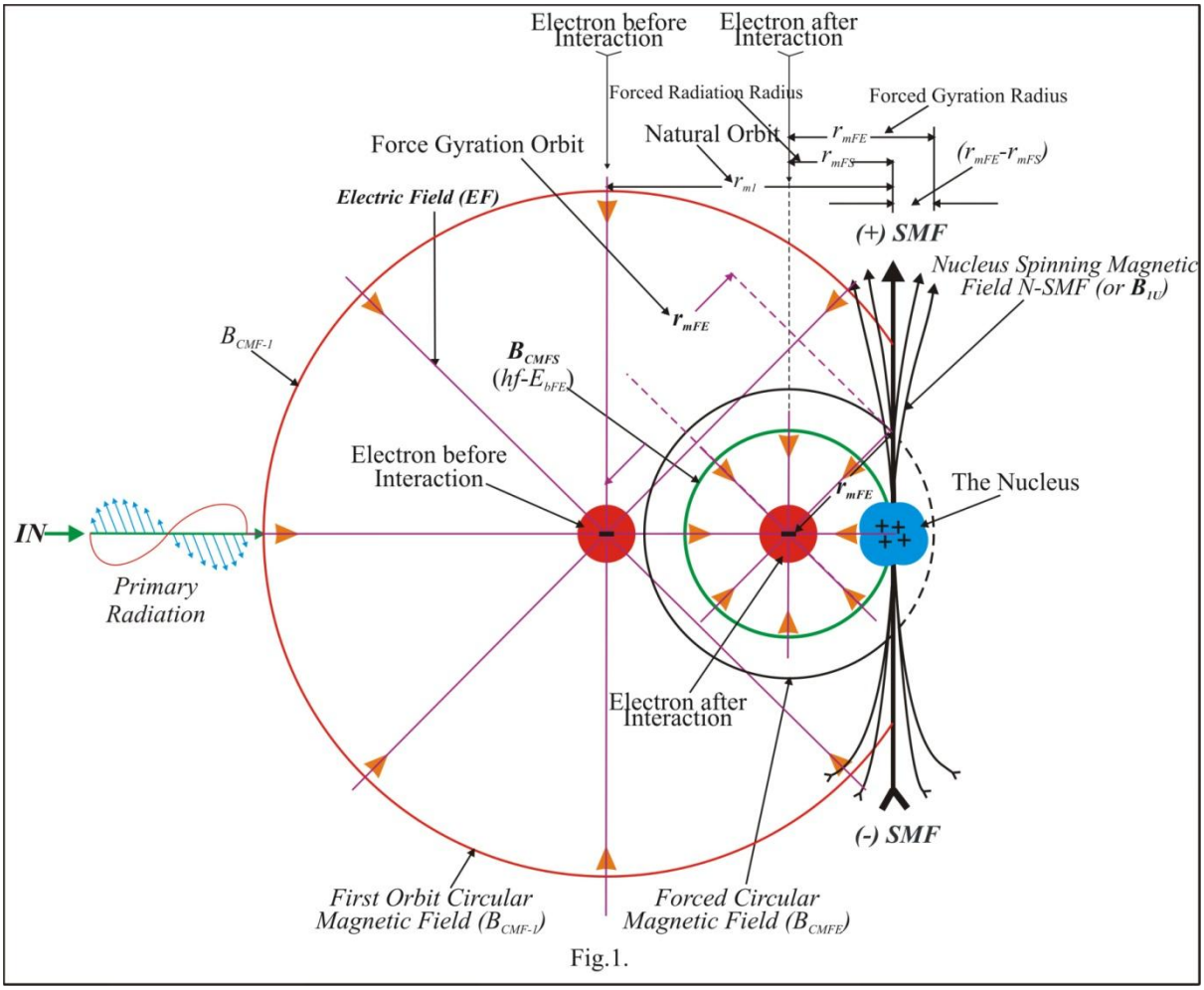

Fig.1.

Figure 1: Cross section of atom, showing electron on left at orbit Magnetic Radius (r_{m1}), and then moved to right by Radiation Magnetic Force (F_{mR}) embedded in Primary Electromagnetic Radiation (*P-EM-R*) to the Forced Binding Orbit (F_{mFE}); energy is divided to Secondary Radiation Energy (E_s) by Secondary CMF (B_{CMFS}) in green color and Electron Binding Energy (E_{bFE}), of Forced CMF (B_{CMFE}) in black color.

The electron acquired energy is added to orbital energy[11], and transferred into B_{CMF}, as

$$h\nu = \left(\frac{B_{CMF-n}^2 m_e c^2 r_{m-n}^4}{2q^2}\right) \qquad (2)$$

Where, B_{CMF-n} is the CMF at n^{th} orbit, r_{m-n} is magnetic radius of gyration at n^{th} orbit.

Rearranging Eq. (2) and solving the physical constants, the Total CMF (B_{CMFT})[12], is

$$B_{CMFT} = \sqrt{\frac{C_A v}{r_{mFE}^4}} \qquad (3)$$

Where, r_{mFE} shown in Figure 1 is forced orbital radius in m, C_A is the constant of Primary Radiation Energy, equal $4.149308727301920546891412494955 6\times10^{-58}$ T^2. m^4. Hz^{-1}.(T^2. m^4. S.) and B_{CMFT} is the Total energetic CMF.

The CMF (B_{2e})[19 - 21],of an electron accelerated to anode in X-ray tube[17], is

$$B_{CMFX} = \frac{qV_e}{r_{mFE}^2 c} \qquad (4)$$

Where, V_e is electron velocity in m s^{-1}, B_{CMFX} is x-ray electron CMF.The CMF given by Eq. (4), increased in similar manner to electron energized by P-EM-R given by Eq. (2), therefore x-ray electron in anode' atom is forced to high binding energy given by

$$E_X = \frac{B_{CMFXT}^2 m_e c^2 r_{mFE}^4}{2q^2} \qquad (5)$$

Where, E_X is x-ray potential difference in x-ray tube [17], B_{CMFXT} is the total CMF,given by

$$B_{CMFXT} = \sqrt{\frac{C_X E_X}{r_{mFE}^4}} \qquad (6)$$

Where, C_X is the constant of energetic x-ray electron with value equal to $6.26209092743045343641407722407 57\times10^{-25}$ T^2. m^4. J^{-1}

The CMF given by Eq. (3) is to be derived in term of frequency, but substituting the right hand of Eq. (2) with related energy frequency formula[11], the B_{CMF} is given by

$$B_{CMF} = \sqrt{C_B v^5} \qquad (7)$$

Where, C_B is the constant of B_{CMF} it is equal to $1.311386461962088469140989628035 4\times10^{-89}$ T^2. Hz^{-5} (T^2. s^5), Eq. (7) can be used to derived both B_{CMFP} and B_{CMFS}.

ϕ_1	$E_k = E_{bFE} + E_{b1}$	v_i	F_{bFE}	V_e	B_{1U}	r_{mFE}	B_{CMFE}	r_{ee}
135^o	367,029.4658483223190377048308617	8.87472968915297204348544014082 09×10^{+19}	0.365014834121956712658897645641 78	3.59315634065594744577059377864 94×10^{+8}	6.340504541976039111264760820189 6×10^{+9}	5.128226737528604274744735151515 5×10^{-13}	729,677.5834042025704679500967033 1	6.162432922896583905628608280709 3×10^{-14}
90^o	299,987.2086720849260427530402735 7	7.253655727653478629098408732512 8×10^{+19}	0.269717285170829681330627303860 29	3.248456209814910163707441147932 9×10^{+8}	5.182283653828594242763780796931 6×10^{+9}	5.094400573542932195469402740687 9×10^{-13}	668,467.2935493425892857541639490 9	7.168909080322940370533677896809 5×10^{-14}
45^o	136,138.2439353323319559527589655 3	3.291806864850837396523206971691 2×10^{+19}	0.082450941033204895352687935789 21	2.188344643828788474001222905864 6×10^{+8}	2.351631743898661125102960797305×10^{+9}	5.458944576563104477016999646324 7×10^{-13}	392,182.0189891304643379311663593 4	1.296610857471820549233005648676 2×10^{-13}
C(6) No	E_b -n (eV)	v_{i-n}	F_{Om-n}	V_{O-n}	B_{1U-n}	r_{m-n}	B_{CMF-n}	r_{ee-n}
6	489.9	1.184572487842916972497521345 78×10^{+17}	1.780083459594140940908836661701 5×10^{-5}	1.312741962605827226634652531452×10^{+7}	8.463508104700806211871779405296 2×10^{+6}	8.818762623028458845705273772789 9×10^{-12}	90.147438334972174884076684517613	8.824442547283359942381180965999 7×10^{-12}
ϕ_1	$E_k = E_{bFE} + E_{b1}$	v_i	F_{bFE}	V_e	B_{1U}	r_{mFE}	B_{CMFFE}	r_{ee}
170^o	409.8504552184498763770527579 0976	9.910136219262527112355065391826 95×10^{+16}	1.362125517331453579164172920591 3×10^{-5}	1.200710640019498553345566579066 2×10^{+7}	7.080569456450349352471825168685 1×10^{+6}	9.641594694263311949385098366531 8×10^{-12}	68.981072883089199231003733096111	1.008785654933192747446339699183 5×10^{-11}
C(6) No	E_b -n (eV)	v_{i-n}	F_{Om-n}	V_{O-n}	B_{1U-n}	r_{m-n}	B_{CMF-n}	r_{ee-n}
5	392	9.478514293415461384344322668825 6×10^{+16}	1.274114053822177705303086098131 2×10^{-5}	1.174271935902251753589847233494 2×10^{+7}	6.772188563059228485514875539653 7×10^{+6}	9.858670210503063299144616399875×10^{-12}	64.524007275953137756127651858268	9.521660364399700872222194223141 4×10^{-12}
4	64.4	1.557184491061111513142281581307 1×10^{+16}	8.484143521661714344630417815971 ×10^{-7}	4.759579462762838550094375246308 1×10^{+6}	1.112573835359730394048872410086×10^{+6}	2.432307275061065929549728247504 1×10^{-11}	4.296561494473033859229106349720 1	3.300333513227374988513995306072×10^{-11}
3	47.8	1.155798426595048607580761794821 1×10^{+16}	5.425266175790119461015962152191 4×10^{-7}	4.100526250995243369034598203218 8×10^{+6}	8.257923809036508204275792112128 4×10^{+5}	2.823237566324440303756288331487×10^{-11}	2.747477065734653537151147749939 3	3.574225420098631472842418167460 2×10^{-11}
2	24.3	5.875711666581523256111404103 37	1.966475844190518362906654417 05	2.923672918929534226832814707956 4×10^{+6}	4.198065869447429903010496826876 9×1	3.959663093143803433281503917621 8×1	0.995867687809397976030007296 72	4.847329330471261062398567479 38

		$91\times10^{+15}$	45×10^{-7}		0^{+5}	0^{-11}	399	2×10^{-11}
1	11.2	2.708146940 9758461098 1266361966 $45\times10^{+15}$	6.153273791 9840666115 9028638113 88×10^{-8}	1.98488184567 2159939069043 $0291252\times10^{+6}$	1.9349110180 169224244328 215827581×1 0^{+5}	5.8324679520 603608754985 470798925×1 0^{-11}	0.311615653 0366031727 2641366016 265	6.127435061 7545938710 2526913285 52×10^{-11}

Table 1: Parameters of Carbon atom (C6)[11] from the bottom left, electron's number (No), binding energy (E_b-n), Ionization Frequency (v_{i-n}), binding force (F_{Om-n}), Orbit Velocity (V_{O-n}), Magentic Field (B_{1U-n}), Magnetic Radius (r_{m-n}), Circular Magnetic Field (B_{CMF-n}), and Electrostatic Radius (r_{ee-n}). The first three electrons are moved to forced binding of angles (ϕ_1) 45^o, 90^o, and 135^o, has the same Primary Electromagnetic Radiation (P-EM-R) frequency, the Radiation Magnetic Force (F_{mR}) added binding orbit force to each, to occupy Forced Binding Energy (E_{bFE}) orbits. From top: released Angle (ϕ), Forced Binding Energy ($E_k = E_{b1} + E_{bFE}$), Ionization Frequency (v_i), Forced Binding Force (F_{bFE}), Electron Velocity (V_e), strong Nucleus magnetic field (B_{1U}), Forced Magnetic Radius (r_{mFE}), CMF (B_{CMFE}), and the electrostatic Radius (r_{ee}). Electron' Energy (E_k) at angle 170^o is 409.8 eV, is forced between orbit 5&6.

Electron shown in Figure 1, in natural orbit has large CMF and radius[12], and since P-EM-R is divided into Secondary Radiation Energy (E_s) and ejected Electron Kinetic Energy (E_k) [22], therefore when electron receive P-EM-R as B_{CMFT} in Eq.(3), it form the Forced Orbit CMF (B_{CMFE}) touchingB_{1U} at an increased magnitudes, reducing gyrating radius to Forced Electron Radius (r_{mFE}); and formed the Secondary CMF (B_{CMFS}) touching B_{1U} at higher magnitudes; both connections determined division of B_{CMFT} into B_{CMFS} and B_{CMFE}, given by

$$B_{CMFT} = B_{CMFS} + B_{CMFE} = \left(\sqrt{\frac{C_A v}{r_{mFS}^4}}\right) + \left(\sqrt{\frac{C_A v}{r_{mFE}^4}}\right) \quad (8)$$

Eq. (7) also derived B_{CMFS}, P-EM-R (B_{CMFP}), and the B_{CMFE}, as

$$B_{CMFE} = \left(\sqrt{C_B v_p^5}\right) - \left(\sqrt{C_B v_s^5}\right) \quad (9)$$

Where, v_p is the P-EM-R frequency and v_s is the secondary radiation frequency, in Table 2.

The B_{CMFXT} in Eq. (6), is divided between x-ray CMF similar to Eq.(8) it is

$$B_{CMFXT} = B_{CMFXS} + B_{CMFXE} = \left(\sqrt{\frac{C_X E_X}{r_{mFS}^4}}\right) + \left(\sqrt{\frac{C_X E_X}{r_{mFE}^4}}\right) \quad (10)$$

Where, B_{CMFXS} is x-ray Secondary Radiation CMF and B_{CMFXE} is energetic electron CMF.

The amount of B_{CMFS} in Eq. (8 or 9) is developed into the secondary radiation energy, as

$$E_s = E_p - E_{bFE} = \left(\frac{B_{CMFS}^2 m_e c^2 r_{mFS}^4}{2q^2}\right) \quad (11)$$

Where, E_p is the P-EM-R energy, E_{bFE} is the forced binding energy, and E_s is the Secondary Radiation Energy.

Since measured electrons energies always higher than calculated[5], and target atoms necessarily contain bound electrons[6]; therefore binding energy in Eq. (2) is added to B_{CMFE} in Eq. (8), forming the Electron Kinetic Energy (E_k)

$$E_k = E_{b-n} + E_{bFE} = \left(\frac{B_{CMFE}^2 m_e c^2 r_{mFE}^4}{2q^2}\right) + \left(\frac{B_{CMF-n}^2 m_e c^2 r_{m-n}^4}{2q^2}\right) \quad (12)$$

Where, E_{b-n} is the binding energy of the orbital electron given in Eq. (2)[11], E_{bFE} is the forced binding energy subtracted from the P-EM-R,shown in Eq. (11).

While x-ray electron kinetic energy (E_{kX}) is derived from B_{CMFXT} in Eq. (10), as

$$E_{kX} = E_{bFE} = \left(\frac{B_{CMFXE}^2 m_e c^2 r_{mFE}^4}{2q^2}\right) \quad (13)$$

Where, E_{bFE} is x-ray electron binding energy, and E_{kX} is x-ray electron kinetic energy.

The Secondary Radiation Energy (E_{sX}), represented by B_{CMFXS} in Eq. (10) is

$$E_{sX} = E_{EX} - E_{bFE} = \left(\frac{B_{CMFXS}^2 m_e c^2 r_{mFS}^4}{2q^2}\right) \quad (14)$$

From Eq. (11&12) energy distribution is guided by the conservation of energy as

$$E_p = E_s + E_{bFE} = \left(\frac{B_{CMFS}^2 m_e c^2 r_{mFS}^4}{2q^2}\right) + \left(\frac{B_{CMFE}^2 m_e c^2 r_{mFE}^4}{2q^2}\right) \qquad (15)$$

The above principle of conservation of energy, is in the core of Compton's formulas [22]

$$h\nu = h\acute{\nu} + mc^2\left(\frac{1}{\sqrt{1-\beta_c{}^2}} - 1\right) \qquad (16)$$

Where, $mc^2\left(\frac{1}{\sqrt{1-\beta_c{}^2}} - 1\right)$ is the kinetic energy of the recoiling electron.

The Forced Radius of Gyration (r_{mF}) is derived from Eq. (4), is

$$r_{mF} = \sqrt{\frac{qV_e}{B_{CMF}\ c}} \qquad (17)$$

As CMF distribution is the essential parameter, therefore from Eq. (5), r_{mFE} is given by

$$r_{mFE} = \sqrt[4]{\frac{2q^2E_e}{m_e c^2 B_{CMF}^2}} \qquad (18)$$

Eq. (18) is important in deriving r_{mFE} when E_e and B_{CMF} is given, as in Table 1. After getting radius,V_e is derived from Eq. (17), and the strong magnetic field B_{1UE} in Table 1, is

$$B_{1UE} = \frac{\sqrt{yf_S^3}}{qv_o} \qquad (19)$$

Table 1, gives F_{mR} in P-EM-R interaction with inter-atomic electrons in Carbon atom (C6), forcing each of first four electrons to high Forced Electron Binding Energy (E_{bFE}).
From these, the x-ray E_{sX}, given by Eq.(14) is similar to Compton E_s, given by Eq. (11), and x-ray E_{kX} given by Eq. (15), is similar to E_k given by Eq. (12); therefore, existence of forced orbit electron energized by high frequency radiation, is synonymous in characteristics to energetic X-rays electrons forced into temporarily orbit in anode atom.

3. Generation of Secondary Radiation

Since the secondary X-rays are emitted by fast moving electrons[8], and tertiary radiation was suggested to be produced by photoelectrons, liberated by the primary X-rays stroking neighbouring atom and emitted bremsstrahlung radiation[9], and no scattered γ-radiation have the original wavelength[5], showing a lower energy phenomenon, and as anode bombardment by energetic electrons produced X-rays[17], suggested a link with energetic Compton electron; and since any substance struck by cathode rays emitted x-rays, and rays are intense from high atomic weight target[5], and Bremsstrahlung x-rays are produced when an energetic electron passes close to the nucleus[17], and that the shortest radiation/particle bursts (such as x-ray and γ-rays) are produced by highest power laser, having high magnetic field[23], all three example simplying the influence of nucleus B_{1U} on x-rays production; thus the long lasting Maxwell's electron acceleration generating EM-R [15], thought to divert attention from E-MR Flip-Flop (F-F) mechanism[14], therefore electron existence with E_s at r_{mFE}, and both E_s and E_{bFE} possess the Primary E_p, and since E_s and E_k are separated in frame shown in Figure 1; while electron maintain Electric Field (*EF*) at point-2 before moving to point-3 along distance d_1 in Figure 2, therefore two interconnected phenomena occurred, (1) the E_s release phenomenon and (2) E_k Electron Ejection phenomenon.

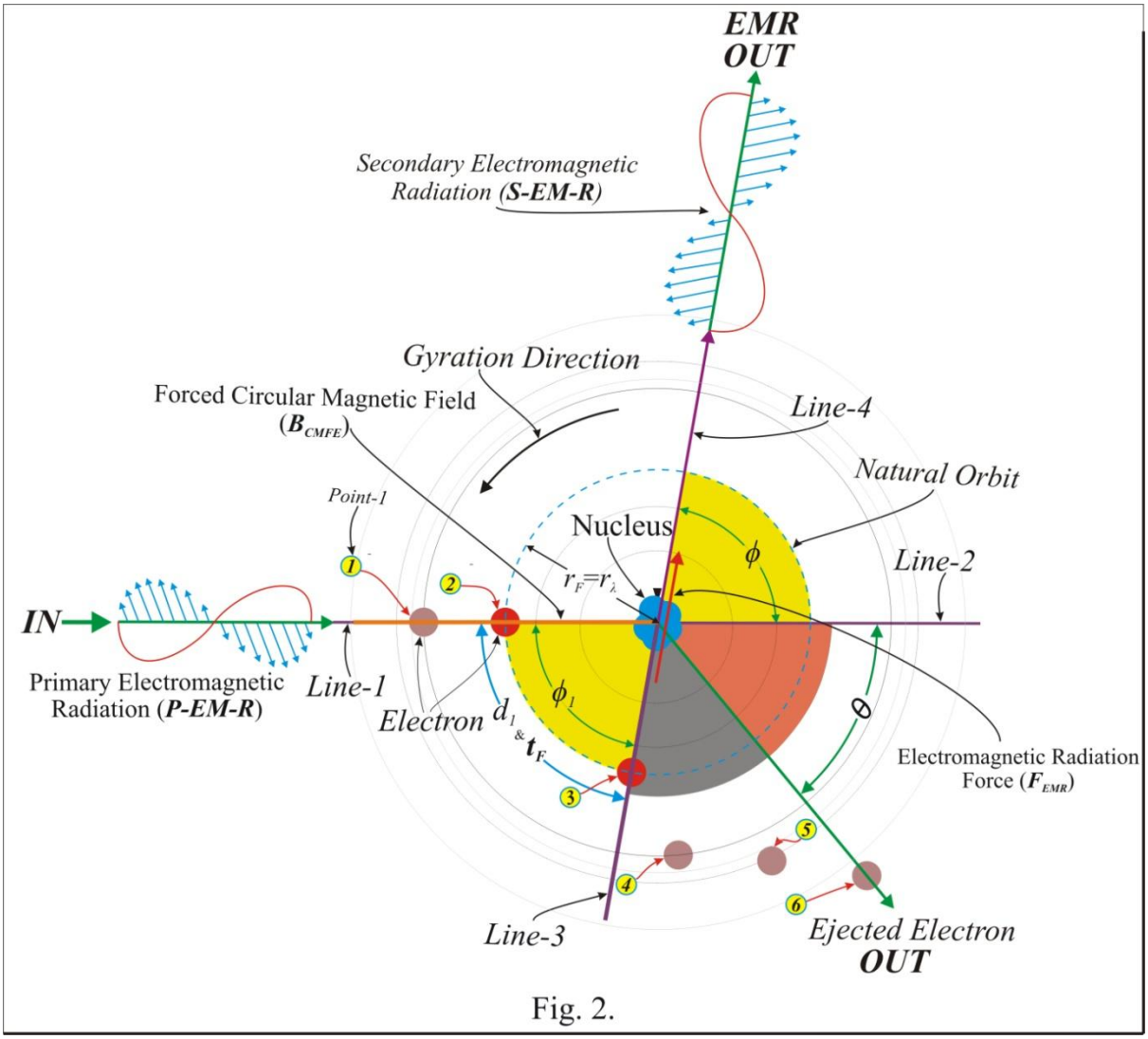

Figure 2: Primary Electromagnetic Radiation (*P-EM-R*) interaction with Carbon atom electron; the Radiation Magnetic Force (F_{mR}) embedded in *P-EM-R* [11] forced electron from point-1 to point-2 at high Binding Force Orbit (F_{bFE}), the Total Circular Magnetic Field (B_{CMFT}) formed Secondary Radiation Energy (E_s) and Forced Binding Energy (E_{bFE}). Electron' relativistic velocity and mass in distance (d_1) is controlled by frequency and angle ϕ, where *CMF* and the Electric Field (*EF*) are Flip-Flop (*F-F*), generating Secondary Electromagnetic Radiation (*S-EM-R*) at point-3, pulled by Electromagnetic Radiation Force (F_{EMR}) and released through lin-4 at angle ϕ with increased wavelength; then electron is ejected at angleϕ.

In $E_s(or\ E_{sX})$ release phenomenon, the interaction of the B_{CMFS} with Nucleus B_{1U}, shown in Figure 1, and given in Table 1, resulted in the Constant state of Radiation (C_R) initiated the Flip-Flop (*F-F*) mechanism producing the Electromagnetic Radiation (*EM-R*), the $C_R$is[16]

$$C_r = B_{1U} \cdot r_{mFS} \qquad (20)$$

Where, r_{mFS} is the Flip-Flop (*F-F*) radius (or magnetic radius r_m, it is quarter of wavelength), and C_r is the EM-R constant equal 5.358581330109045523365615366137 9×10^{-3}T.m[16].

This occurred, when electron in Figure 2 start moving from point-2 to point-3 along distance d_1, initiate the Flip-Flop (*F-F*) mechanism; where the combined *CMF-EF* Flip-Flop (*F-F*), producing the Secondary Electromagnetic Radiation (S-EM-R)[14], the Flipping Time (t_F)is[16]

$$t_F = \frac{4\,\pi\,m}{qB_{1U}} = \frac{1}{\acute{\nu}} \qquad (21)$$

Where, $\acute{\nu}$ is the S-EM-R frequency, and t_F is the Flipping-Time[16], given in Table 2.

The *F-F* ended at point-3 in Figure 2, where E_s in Eq. (11), is transformed into S-EM-R[14], and released through line-4, parameters of which are in Table 2, the frequency is

$$\acute{\nu} = \frac{B_{CMFS}^2 m_e c^2\, r_{mFS}^4}{2hq^2} \qquad (22)$$

The wavelength of which is given by

$$\lambda` = \frac{2h\ q^2}{B_{CMFS}^2 m_e\ c\ r_{mFS}^4} \qquad (23)$$

The S-EM-R is produced at line-3, but pulled and released at line-4, force causing this is

$$F_{EMR} = B_{1US} B_{CMFS} \mathrm{r}_{mFS}^2 c \qquad (24)$$

Where, F_{EMR} is Electromagnetic Radiation Force in Newton, given in Table 3.

The S-EM-R will be released at speed of light, given by[16]

$$c = \frac{qB_{1U} r_\lambda}{\pi\ m} = \frac{1}{\sqrt{\epsilon\mu}} \qquad (25)$$

Where, ε is the permittivity of free space, μ is the permeability of free space.

4. Kinematics of the Compton Interaction

Kinematics of Compton interaction were solved based on wave particle duality[24]; while as shown in Figure 2, S-EM-R production is carried between poin-2 and point-3, along arc d_1, travelled by electron during the Flip-Flop (*F-F*) mechanism, therefore this length is given by

$$d_1 = t_F V_e = \frac{2\ \pi\ r_{mFS}\ \phi_1}{360} \qquad (26)$$

Where, ϕ_1 in Fig. 2, is the angle formed between line-1 where P-EM-R interacted and forced electron from point-1 to point-2, and line-2, where S-EM-R is produced at point-3, V_e is electron velocity in m.s^{-1}, t_F is the Flipping time ($1/\acute{v}$) in s and d_1 is the arc distance in m.

Since Compton Effects is characterized by S-EM-R increased in wavelength, and the increase is greater at large angles[22], therefore E_p reduction by E_k is the main factor in wavelength increases; while ϕ_1 increased by increases in d_1, and by t_F, and since ϕ_1 is equal to ϕ, hence substituting r_{mFS} with($\frac{\lambda`}{4}$)[16] in Eq. (26), therefore, angle ϕ_1 is

$$\phi_1 = \emptyset = \frac{360\ (4)\ t_F V_e}{2\ \pi\ \lambda`} \qquad (27)$$

From Eq. (27), the S-EM-R wavelength is

$$\lambda` = \frac{360\ (4)\ t_F V_e}{2\ \pi\ \phi_1} \qquad (28)$$

Since *the energy of ejected electron varied with the angle of recoil* from the direction of the beam[5], and electrons with forward velocity of about 0.7 the speed of light been detected[8], therefore, electron movement between Point-2 and Point-3 in Figure 2, during the *F-F* mechanism, created relativistic velocity (V_R), hence from Eq. (27), V_R is

$$V_R = \frac{2\ \pi\ \phi_1 \lambda}{360\ (4)\ t_F} \qquad (29)$$

Where, V_R is the relativistic velocity in m.s^{-1}, and since $\frac{\lambda`}{t_F}$ is equal the speed of light c, hence

$$V_R = \frac{2\ \pi\ c\ \phi_1}{360\ (4)} \qquad (30)$$

Solving constants in Eq. (30), the V_R during distance d_1 in Figure 2, is

$$V_R = K_v \phi_1 \qquad (31)$$

Where, K_v is the constant of velocity while radiating S-EM-R at specific angle ϕ_1 its equal to 1.308996938995747182692768076366 5e+6 m.s^{-1}. Degree^{-1}.

The equivalence of radiation energy and kinetic energy, for the above V_R is given by

$$E_R = h\acute{v} = \frac{m_e V_R^2}{2} \qquad (32)$$

Modeling Eq. (32), and substituting V_R with Eq. (30), the Relativistic Mass is given by

$$m_R = \frac{2(360)^2\ (4)^2 h\acute{v}}{4\ \pi^2 c^2 \phi_1^2} \qquad (33)$$

Solving the physical constants into digits, therefore, m_R, is given by

$$m_R = \frac{K_m \acute{v}}{\phi_1^2} \qquad (34)$$

Where, K_m is the constant of relativistic mass it is equal to $7.7340880807314632074240051521845\times10^{-46}$ kg. degree^2. Hz^{-1} (or kg. degree^{-2}. S).Table 2 give electron parameters during distance d_1, where electron movement shown in Fig. 2 is synchronized with fast occurs t_F, by controlling and changing V_e and m_R.

E_P	λ_P	$E_{bFE} = E_p - E_s$	$E_S = E_P - E_{bFE}$	λ_S	r_{mFS} (r_λ)	v_S	t_F	m_R	V_R	d_1	$-F_{mR}$	*angle*	
563,954.8963035196609603757157 1431	2.2 ×10^{-12}	1.3612704393533233195595275896553×10^{+5}	427,827.8523681873290044229567 4879	2.9×10^{-12}	7.25×10^{-13}	1.0344827586206896551724137931034×10^{+20}	9.6666666666666666666666666666667×10^{-21}	3.9510028509483847802932337942192×10^{-29}	5.8904862254808623221174563436493×10^{+7}	5.6941366846315002447135411321943×10^{-13}	0.2110	ϕ	45^o
												θ	24.5^o
563,954.8963035196609603757157 1431	2.2 ×10^{-12}	2.9997600867208492604275304027357×10^{+5}	263,978.8876314347349176226754 4075	4.7×10^{-12}	1.175×10^{-12}	6.3829787234042553191489361702128×10^{+19}	1.5666666666666666666666666666667×10^{-20}	6.0946320573139977993884984989378917×10^{-30}	1.1780972450961724644234912687299×10^{+8}	1.8456856839840035275968029876768×10^{-12}	0.2227	ϕ	90^o
												θ	47.8^o
563,954.8963035196609603757157 1431	2.2 ×10^{-12}	3.6701826584832231903770483086 17×10^{+5}	196,936.6304551973419226708848 5261	6.3×10^{-12}	1.575×10^{-12}	4.7619047619047619047619047619048×10^{+19}	2.1e-20	2.0207951089506729916843700182075×10^{-30}	1.7671458676442586966352369030948×10^{+8}	3.7110063220529432629339974960499×10×10	0.1435	ϕ	135^o
												θ	69.4^o
10,339.173098897860450940221454762	1.2 ×10^{-10}	398.65045521844987637705275790976	9940.5226436794105745631686968527	1.2481242851517785837437332070301×10^{-10}	3.1203107128794464593593330175753×10^{-11}	2.4036067847483505749862620097013×10^{+18}	4.1604142838392619458124440234337×10^{-19}	6.4324244237672989307337453401683×10^{-32}	2.2252947962927702105777057298231×10^{+8}	9.2581482562496218744673811737206×10^{-11}	0.0016	ϕ	170^o
												θ	85.1^o
E_P	λ_P	$E_{bFE} = E_p - E_s$	$E_S = E_P - E_{bFE}$	λ_S	r_{mFS} (r_λ)	v_S	t_F	m_R	V_R	d_1	$-F_{mR}$	*Angle*	

Table 2: The relativistic parameters of the electron during the generation of the Secondary Electromagnetic Radiation (S-EM-R), at distance d_1 in Figure 2. On the left is the Primary Electromagnetic Radiation (P-EM-R) Energy (E_P), P-EM-R Wavelength (λ_P), the Electron' Forced Binding Energy (E_{bFE}), the S-EM-R Energy (E_s), the S-EM-R Wavelength (λ_s), S-EM-R Magnetic Radius (r_λ), S-EM-R Frequency (v_s), the Flipping Time (t_F), the Relativistic Mass (m_R), the Relativistic Velocity (V_R), the operational arc length (d_1), the Radiation Magnetic Force (F_{mR}) which expel the recoil electron, and the angle through which S-EM-R is released (ϕ), and the angle θ through which electron is ejected.

Since Compton formulas in essence related both P-EM-R and S-EM-R wavelengths and angle, and S-EM-R wavelength with the ejected electron' angle[8, 22] as shown in Figure 2, therefore, S-EM-R giving in Table 2, is derived using Compton formula, given by

$$\lambda` = \lambda + \frac{h}{m_0\, c}(1 - cos\, \phi) \qquad (35)$$

Where,

$\frac{h}{m_0\, c}$ is equal to 2.424632062160358924301299057755×10^{-12}. Although Eq. (35) was derived from the principle of conservation of momentum [22], but it originated from the energy of the system[5], therefore this greatly tested formula is valid in our model.

ϕ	r_{mFS} (r_λ)	B_{1US}	B_{CMFS}	F_{EMR}
45^o	7.25e-13	7.391146662219373135676710849845e+9	394160.85381530235324973627791679	0.4593911008284080858676393296125 2
90^o	1.175e-12	4.560494747490289749135026513754365e+9	117875.57925509022830191328032704	0.2226551720909207521992781893694
135^o	1.575e-12	3.402273860386695570390866899135 2e+9	56665.289400230247119717347572822	0.1434725279719041536366092238773 4
170^o	3.1203107128794464593593330175753e-11	1.717322992223459026563223533089e+8	32.435746762855858215365265380161	0.0016270197492474151137132500813 5

Table 3: The Electromagnetic Radiation Force (F_{EMR}), resulted from Strong Spinning Magnetic Field (B_{1US}) interaction with the CMF (B_{CMFS}) of the produced Secondary Electromagnetic Radiation (S-EM-R) after completing the Flip-Flop (F-F) mechanism; F_{EMR} pulls S-EM-R from ϕ_1 to ϕ. The data could also be used in Eq. (49) to derived speed of light (c).

5. The Ejected Electron

When S-EM-R is released, its part in F_{mR} given by Eq. (1), ceased to exist, and turned into recoil force, given by

$$-F_{mR} = (B_{1U}\, B_{2e} r_m^2\, c) - \left(\sqrt{y\, v`^3}\right) = ma = m\frac{dV}{dt} \qquad (36)$$

When S-EM-R is released, F_{mR} impart electron with force, the velocity of which is

$$V_S = \frac{\left\{(B_{1U}\, B_{2e} r_m^2\, c) - \left(\sqrt{y\, v`^3}\right)\right\} t}{m} \qquad (37)$$

Where, V_S is secondary electron velocity.

Since forced binding energy doesn't released with E_s, therefore electron E_{bFE} is added to the electron energy, therefore, the ejected electron energy is given by

$$E_e = E_C + E_{bFE} = \frac{m\, V_S^2}{2} + \left(\frac{B_{CMFE}^2\, m_e c^2 r_{mFE}^4}{2q^2}\right) \qquad (38)$$

Where, E_C is the electron kinetic energy in J.When S-EM-R is released, x-ray electron is attracted by E_X potential on anode[17], given in Eq. (5), thus for electron to accelerate towards anode, E_X must exceed E_e, hence

$$E_X \gg E_e \qquad (39)$$

Since angle ϕ and θ are related[22], therefore Compton ejection formula is used

$$cot\, \theta = -(1 + \alpha)\, tan\, \frac{1}{2}\phi \qquad (40)$$

Where, $\equiv \frac{h\nu}{mc^2}$, and θ is the angle made by the ejected electron with the forward direction of propagation of the beam, in Figure 2.

6. Results and Discussion

The re-interpretation of Compton Effect illustrated in Figures1&2 and given in Tables 1&2, shows the phenomenon as an inter-atomic mechanism, that received primary electromagnetic radiation, utilized some of the incoming radiation energy in moving to higher orbital level, then radiating major energy as secondary electromagnetic radiation.

The Forced Binding Energy (E_{bFE}) shown in Figure 1, and given in Table 1 illustrate an important part of inter-atomic characteristic of balance of magnetic force plus electrostatic force with the centripetal force at the natural orbit[11, 12], when such balance is violated by excitation potential, an spectral line is radiated, but when x-ray or γ-rays forced electron to higher orbit, the nucleus magnetic field help to transform this energy into higher radiation.

In Compton Effect, the Primary Radiation Energy (E_p) is reduced by Electron' Kinetic Energy(E_k) to form the secondary Energy (E_s); therefore the energy of the produced Secondary Electromagnetic Radiation(S-EM-R) energy, is always less by the amount of Electron' Kinetic Energy (E_k), leading to an increase in the wavelength.

When Secondary Electromagnetic Radiation (S-EM-R) is produced, an Electromagnetic Radiation Force (B_{EMR}) is established between the nucleus magnetic field(B_{1U}) and the radiation CMF(B_{CMFS}), pulling Secondary Electromagnetic Radiation (S-EM-R) to emerged at angle ϕ.

When Secondary Electromagnetic Radiation (S-EM-R) is released, the Radiation Magnetic Force (F_{mR}) stops abruptly and turned into recoil force ejecting electron at specific angle θ; while if anode potential is higher than x-ray electron energy (E_e) electron will flow as anode current, if anode potential is less than electron energy (E_e) electron will be ejected from the atom.

At high Prime Electromagnetic Radiation (P-EM-R) frequency, the Radiation Magnetic Force (F_{mR}) is high, forcing electron to high binding energy near nucleus, thus great energy is deduced by electron as binding energy (E_{bFE}), explains the discrepancy of Compton effect at high energies.

At low x-ray frequency, forced binding energy (E_{bFE}) given by ϕ_1=17^o in Tables 1&2 is little, the Prime Radiation Energy (E_p) and the Secondary Radiation Energy (E_s) are nearly equal.

Discrepancy between high and low energies, shown in Table 1, by forced binding energy (E_{bFE}) 409.8 eV at 170^o which is 3.8% of the Prime Electromagnetic Radiation (P-EM-R); while forced binding energy (E_{bFE}) at 135^o reached 367 keV or 65% of the P-EM-R.

This explains the discrepancy in Compton Secondary Electromagnetic Radiation (S-EM-R) ratio over Prime Electromagnetic Radiation (P-EM-R) at Soft X-rays (SX) which is 99%and 0.13% at end of γ-rays at 3.08 fm[8], due to the very high forced binding energy (E_{bFE}).

Although the frequency of the Prime Electromagnetic Radiation (P-EM-R) in Table 1 is equal for 45^o, 90^o and 135^o, but at 45^o, the Secondary Energy (E_s) reached 76% of Prime Electromagnetic Radiation (P-EM-R), while at 135^{o}it is only 35%, hence each ray interacted with specific electron in specific orbit.

From above, it is clear why Compton Effect will not occur from electrons with binding energies greater than the energy transfer.

For Compton Effect to occurred, forced binding energy (E_{bFE}) should be greater than the orbit binding energy (E_{b-n}).

7. Conclusion

Compton Effect is reinterpreted based on the ambiguous characteristics of the Circular Magnetic Field (CMF) discovered in 1819 by Hans Christian Oersted[25], although it represents an important element in the dynamics of microscopic world[12], but neglected by physicists.This line include the knowledge of the nucleus strong magnetic field (B_{1U}) [13], and the Flip-Flop (*F-F*) mechanism suggested to generate Electromagnetic Radiation (F_{mR})[11], while the Radiation Magnetic Force (F_{mR}) was suggested to embedded EM-R (as $F_{mR} = \sqrt{yv^3}$). The F_{mR} embedded in the X-ray and γ-rays Primary Electromagnetic Radiation (P-EM-R) interacted with the inter-atomic electron, and forced electron to move to high binding energy at temporarily forced orbit, where the CMF is automatically divided into a binding energy responsible of the gyration of electron in this temporary orbit, and high secondary energy shown in Figure 1.

A relation been established between X-rays tube energetic electrons and inter-atomic electrons energized by Radiation Magnetic Energy (E_{mR}); the penetration of x-ray electrons into high forced binding orbit of anode's atoms, created the same state of inter-atomic electron forced by the Radiation Magnetic Force (F_{mR}), shown in Figure 1.

Both the Total Radiation Circular Magnetic Field (B_{CMFCT}) created by primary electromagnetic radiation, and the Total X-Ray CMF (B_{CMFXT}), created by energetic x-ray tube electron, are divided to form the Secondary CMF (B_{CMFS}), and the Forced Binding Electron energy CMF (B_{CMFE}); hence both CMF formed Electron Kinetic Energy (E_k) and the Secondary Radiation Energy (E_s).

As electron start moving in the short arc distance (d_1) in Figure 2, within the Flipping Time ($t_F = \frac{1}{\vartheta}$), the Flip-Flop *(F-F)* mechanism to transform both the CMF and the Electric Field (EF) into the secondary radiation, is also performed within this short time, thus *F-F* is synchronized with electron' velocity, this is by controlling electron' velocity through angle ϕ and electron' mass by frequency and angle ϕ, at the end of which the secondary electromagnetic radiation is generated at angle $\phi_1$but pulled by electromagnetic Radiation Force (F_{EMR})to emerge at angle ϕ, examples of the force is given in Table 3, the secondary electromagnetic radiation is given in Table 2 and shown in Figure 2, which is in core of this phenomenon, formulas are derived to express the increased wavelength and reduced frequency of the generated secondary electromagnetic radiation. Compton formulas are valid in producing the increased secondary wavelength, and when this radiation is released, the recoil force ejected the electron at angle θ, this angle is derived using Compton formula.

In this interpretation, the Compton Effect combined several microscopic phenomena, such as the temporarily occupation of electron at high binding energy in atom due to the Radiation Magnetic Force (F_{mR}) embedded in EM-R, as given in Table 1 for each of the four primary radiation frequencies; the synchronization within distance (d_1) while electron is moving while carried Flip-Flop (F-F) mechanism, is another mechanism the details of which is given in Table 2, it required electron' velocity (V_{R}) and mass (m_R) to be controlled by the secondary radiation frequency and ejected angle ϕ for the later, and by the angle ϕ for the former, the related data in Table 2, give more weight to the Flip-Flop (*F-F*) mechanism over the acceleration[15] mechanism. This mechanism showed the correct suggestion by Raman, and some of his contemporary physicists who interpreted Compton Effects as secondary radiation generated inside the atom [9, 10], but as shown the line taken by physics during that period can't substantiate such explanation.

In Compton effect, the reduction of forced binding energy (E_{bFE}) from Prime Energy (E_p), increased radiated Secondary Energy (E_s) wavelength, and justified the Secondary Electromagnetic Radiation (S-EM-R) mechanism, as energy is conserved, while electromagnetic radiation as spreading waves is maintained, and doesn't required the conservation of momentum[22].

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