WHY ELECTRONS AND NUCLEONS POSSESS PERSISTENT SPIN MOTION

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In nature, nothing is said to occur without reason/purpose. For example, our hearts beat persistently without having a source of infinite energy, which does not happen without reason. The reason is due to their unique/special structure that provides all the properties our hearts possess. In the same way, as all electrons, nucleons, and all other particles, or quanta (since quantum mechanics is applied to all particles, these should be known as quanta) possess persistent spin motion without having any source of infinite energy; there should be some purpose. And the purpose should be due to their unique structure that provides all the properties they display. At present, research on the topic has determined as to how electrons, nucleons, and other particles, possess persistent spin motion through their unique structures, and the purpose why they possess persistent spin motion. These determinations provide very clear and complete explanations of all the phenomena/events related to them, as well as the structures and/or properties of their systems, for example, nuclei, their beams, and current-carrying specimens.

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1. INTRODUCTION

As we know, in nature, nothing occurs without reason/purpose. For example, our hearts beat persistently without having a source of infinite energy, which does not happen without reason, as there is an important reason as to why they beat persistently, in addition to why they have a special structure that keeps them beating persistently to provide all the properties our hearts possess. Therefore, as all electrons, nucleons, and all other particles, or quanta (since quantum mechanics is applied to all particles, these should be known as quanta) possess persistent spin motion without having any source of infinite energy, there should be some purpose as to why they possess persistent spin motion. In addition, such quanta should have a special structure that keeps them spinning persistently and provides all the properties they display.

Further, as we know, all the phenomena/activities related to our hearts, for example, the continuous blood circulation taking place in our bodies, are the effects of the purpose behind the persistent beating of our hearts, its special structure and properties. Similarly, all the phenomena/activities related to electrons, nucleons, and so forth should be the effects of the purpose behind their persistent spin motion, their special structures and properties.

Therefore, the purpose as to why all electrons, nucleons, and all other particles, possess persistent spin motion (see Sec. 2), their special structures and properties (see Sec. 3) have been determined. These determinations enable us to give very clear and complete explanation of all the phenomena/events related with them (see Sec. 4.1), and additional knowledge regarding the structures and/or properties of their systems, for instance, nuclei, their beams, and current carrying substances (see Sec. 4.2).

Currently, it has been assumed that the electrons, nucleons, and all other particles possess wave nature, and all the phenomena related to them take place due to their dual nature (wave nature and particle nature). Their wave nature has been assumed because this alone and not the other quantum idea can account for the phenomena of interference and diffraction of electrons and photons. However, the concept of their wave nature cannot be true (for its verification, see Sec. 1.1, Ref. 1), and the phenomena of interference and diffraction of electrons and photons cannot take place due to their wave nature (for its verification, see Sec. 1.2, Ref. 1).

2. DETERMINATION OF PURPOSE AS TO WHY ELECTRONS AND NUCLEONS POSSESS PERSISTENT SPIN MOTION

The spin motion of electrons, nucleons, and all other spinning particles generate the following two properties:

2.1 First property

The spin motion of a spinning particle generates a tendency toward linear motion in it along the direction of its spin angular momentum L_S (for its verification, see Sec. I B, Ref. 2). Therefore, as electrons, nucleons, and all other particles possess spin motion, they share a tendency of generating linear motion along the directions of their respective L_S.

If the frequency of the spin motion of such a particle is increased by some means, there will come a point when the particle starts moving along the direction of its L_S. Following this, as the frequency of spin motion of the particle increases, the velocity of the particle goes on increasing in accordance with the following expression[2]

$$v^2 = h\omega / m \quad \text{.........} \qquad (1)$$

where m, v, and ω respectively are the mass, linear velocity, and frequency of spin motion of the particle, respectively, and h is the Planck's constant [for verification of the truth of expression (1), see Sec. I A, Ref. 2].

As all particles, such as electrons, protons and neutrons possess such frequencies of spin motion, which keeps them moving continuously with some linear velocity (v), they are always found in a state of motion, which is oriented along the directions of their respective L_S (for its verification, see Ref. 3) Also, their linear velocity (v) varies in the same way as the frequency of their spin motion (ω) varies, according to expression (1).

2.2 Second property

As a particle obtains kinetic energy (E_K) and linear momentum (p_{LIN}) due to its linear motion, similarly, it obtains spin energy ($E_S = h\omega / 2$, for further information, see Sec. II, Ref. 2) and spin momentum ($p_S = h\omega / v$, see Sec. II, Ref. 2) due to its spin motion. (For verification that the particle obtains p_S due to its spin motion, see Sec. I C, Ref. 2.)

Therefore, electrons, nucleons, and all particles possess motional energy (E_M) = E_K + E_S and motional momentum (p_M) = p_{LIN} + p_S. And, during their motion, their E_M, p_M and L_S conserve, not their E_K and p_{LIN}. [To understand as to how E_M, p_M and L_S of electrons and nucleons conserve, see Sec. 3.1. And for verification of truth that their p_M conserve, see Sec. I D, Ref. 2.] Due to conservation of their E_M, p_M and L_S, there arise no situation of violation of the laws regarding the conservation of their energy, momentum and spin angular momentum, during their motion in any condition, for examples:

1. During motion of an electron, when it is accelerated by a large voltage (e.g., in Bertozzi's experiment[4]), as the rate of increase in its velocity starts decreasing (which causes decrease in its E_K and p_{LIN}) after attaining its relativistic velocity, at this point, the rate of increase in its frequency of spin motion starts increasing. In turn, this causes an increase in its E_S and p_S. The increase in E_S and p_S of electrons compensates the decrease in its E_K and p_{LIN}, and thus the E_M and p_M of the electron are conserved. The increased rate in the frequency of the electron's spin motion takes place in such a manner (see Sec. 3.1) that there is no violation in the law of conservation of its L_S.

Currently, it is believed that, as the rate of increase in the velocity of electron starts decreasing (which causes decrease in its E_K and p_{LIN}) after attaining its relativistic velocity, its moving mass (m_{mov}) starts to increase in order to conserve its E_K and p_{LIN}. However, this cannot be true (for reasons as to why, see Sec. 5.4.2, Ref. 1). The eqn. for the moving mass of electron $m_{mov} = m_e / \sqrt{(1 - \mathrm{v}^2 / c^2)}$ (where m_e is the rest mass of the electron and c is the velocity of light) is correct, but m_{mov} is not the moving mass of the electron. It (m_{mov}) is actually the effective mass (m_{eff}) of the electron, which is obtained as the result of the superposition of the effect of the spin motion of the electron on its m_e. And the relativistic kinetic energy $E_K = [m_e c^2 / \sqrt{(1 - \mathrm{v}^2 / c^2)}]$ - $m_e c^2$ and the relativistic linear momentum $p_{LIN} = m_e \mathrm{v} / \sqrt{(1 - \mathrm{v}^2 / c^2)}$ of the electron are its E_M $(= m_{eff}\, \mathrm{v}^2 / 2)$ and p_M $(= m_{eff}\, \mathrm{v})$ respectively, which are obtained as the result of the superposition of the effects of E_S and p_S of the electron on its E_K $(= m \mathrm{v}^2 / 2)$ and p_{LIN} $(= m \mathrm{v})$ respectively. [For further information as to how these are obtained, see starting from the last but one paragraph (column-1, page-69) to the end of the second paragraph (column-2, page-70), i.e., the end of Sec. IV C, Ref. 2.]

2. During the motion of the electron along its elliptical orbit, since the velocity of the electron varies, the E_K and p_{LIN} of the electron also varies accordingly. Then, the ω of the electrons varies in such a way that the variations caused in its E_S and p_S are due to the variation in its ω, which may balance the loss/gain occurred in its E_K and p_{LIN} due to variation in its velocity. Thus, the E_M and p_M of the electron remain conserved throughout its orbital motion. The spin angular momentum of electron also remains conserved (for further information, see Sec. 3.1).

NOTE: During the motion of the electrons along their elliptical orbits, as well as during their motion after attaining relativistic velocity by them, the variation between their v and ω does not take place according to eqn. (1), but rather takes place according to the following eqn.

$$\mathrm{v}^2 = h\omega / m_{eff} = h\omega / m_{mov} \quad (2)$$

3. DETERMINATION OF THE SPECIAL STRUCTURES OF ELECTRONS, PROTONS AND NEUTRONS

3.1 Determination of the special structure of electrons

The current concepts regarding the structure of electron that it is like a ball of electrical charge (-e), and its properties of magnetic field, spin magnetic moment (μ_S) etc. are obtained due to the spin motion of its ball of charge, are not true (for verification of its truth, see Sec. 1, Ref. 5).

The electron has a special structure. It also possesses a degree of magnetism by the virtue of nature; in the same way, the electron possesses a charge ($-e$). Further, the electron's magnetic field occurs due to this magnetism, which is in the form of a circular ring, as shown by a dark, solid lined circle around the charge of the electron [see Fig. 1(a)], where a spherical ball indicates the charge, in a similar way to the rings around the planet Saturn, for instance. Circulating the electron's ball of charge is the electric field (which has not been shown in Fig. 1), and around the electron's ring of magnetism is the magnetic field, which is shown by broken line circles, Fig. 1(a). The electron's ring of magnetism and the ball of charge both spin with frequencies ω_{EM} and ω_{EC} respectively, but in opposing directions, as shown by arrows in opposing directions, Fig. 1(b), where the ball of charge is represented by quite a thick, dark circle, with the ring of magnetism represented by a comparatively thinner, dark circle.

The opposing spin motion of the electron's ring of magnetism and the ball of charge is a special characteristic caused by the special structure of electrons. Further, then their fields interact (electromagnetic interaction) with each other in such a way that their spin motion persists (for further information, see Sec. 3.4).

When the electron's ring of magnetism and the ball of charge spin with frequencies of ω_{EM} and ω_{EC} respectively, due to their spin motion, the linear velocities $\mathrm{v_{EM}}$ and $\mathrm{v_{ES}}$ are respectively generated in them, according to expression (1) along the directions of their respective spin angular momentum L_{SM} and L_{SC}. Consequently, the electron obtains a linear velocity $\mathrm{v_E}$ ($= \mathrm{v_{ES}} - \mathrm{v_{EM}}$ or $= \mathrm{v_{EM}} - \mathrm{v_{ES}}$) along the direction of its spin angular momentum L_S. Also, corresponding to velocity $\mathrm{v_E}$, the frequency of spin motion (ω_E), which is obtained according to expression (1), can be assumed as the frequency of the spin motion of the electron. During the motion of the electron along its elliptical orbits, or after attaining relativistic velocity by it, the frequency of the spin motion ω_E of the electron is obtained corresponding to its linear velocity $\mathrm{v_E}$ $(= \mathrm{v_{ES}} - \mathrm{v_{EM}})$, according to expression (2).

During the motion of the electron along its elliptical orbits, or after attaining relativistic velocity by it when its v varies, (i.e., decreases/increases), in order to conserve its E_M , p_M and L_S , it contracts/expands. In turn, its radius (r) decreases/increases, which causes a consequential decrease/increase in its moment of inertia I $(= m_e r^2)$. But the decrease/ increases in the I of the electron causes a decrease/increase in L_S $(= I\, d\theta / dt$, where $d\theta / dt$ is the angular velocity of its spin motion) of the electron. Therefore, in order to conserve the L_S of the electron, the $d\theta / dt$ of the electron increases/decreases, which causes an increase/decrease in the ω of the electron, according to expression (2). The increase/ decrease in ω of the electron also causes an increase/decrease in the E_S and p_S of the electron, which respectively conserves the E_M and p_M of the electron by compensating the decrease/increase in its E_K and p_{LIN} caused due to variations (decrease/increase) in its v. The concept of the expansion/contraction of the electron is thought hard to believe, but it cannot be ruled out - as the proton shrinks in size[6], the electron can also shrink. Secondly, as we know, photons, which are bundles (quanta) of radiation energy and behave like particles (see Sec. 2, Ref. 7), are emitted from the orbiting electrons; this can be possible only if, during their excitation, they are filled with radiation energy, and due to the fact that they expand. After their excitation, they suddenly contract (shrink), and emitting the radiation energy filled in them during their excitation collectively in the form of photons, they transit back (for detail information, see Sec. III B, Ref. 2). The times an orbiting electron expands and contracts during its one complete orbital motion along its elliptical orbit is equal to the number of photons of different frequencies of spin motion, with varying levels of radiation energy contained in them. These photons comprise the number of fine lines in the fine structure of spectral lines, their frequencies and intensities in accordance as the number of photons, their frequencies of spin motion and the levels of radiation energy contained in them are (for detail information, see Sec. III, Ref. 2).

When the ω_{EC} and ω_{EM} of the electron are happened to be such that the generated v_{EC} in the ball of charge due to its spin motion along the direction of its L_{SC} is greater than the generated v_{EM} in the ring of magnetism due to its spin motion along the direction of its L_{SM} (i.e. $\mathrm{v}_{EC} > \mathrm{v}_{EM}$), the electron obtains v_{E} along the direction of L_{SC} (i.e. the L_S of the electron lies along the direction of L_{SC}). When the ω_{EC} and ω_{EM} of the electron are happened to be such that the generated v_{EC} in the ball of charge due to its spin motion along the direction of its L_{SC} is lesser than the generated v_{EM} in the ring of magnetism due to its spin motion along the direction of its L_{SM} (i.e. $\mathrm{v}_{EC} < \mathrm{v}_{EM}$), the electron obtains v_{E} along the direction of L_{SM} (i.e. the L_S of the electron lies along the direction of L_{SM}). The former condition (i.e. the electron possesses it's v_{E} along the direction of L_{SC}) normally occurs. The later condition (i.e. the electron possesses it's v_{E} along the direction of L_{SM}) occurs very rarely and under special circumstances (see Sec. 2, Ref. 8).

The spin magnetic moment (μ_S) the electron possesses, is generated due to the spin motion of its ring of magnetism and occurs along the direction of L_{SM} . As normally v_{E}

occurs along the direction of L_{SC}, and L_{SC} occurs in the direction opposite to the direction of L_{SM}, v_E occurs in the direction opposite to the direction of μ_S.

3.2 Determination of the special structure of protons

The proton possesses the same amount of charge (+e) as the electron possesses (-e), however, the proton is about 2×10^3 times more massive than the electron, meaning that the proton possesses something more, probably some material, along with its charge (+e). Its charge and material most likely exit together in the form of a ball, as the charge of electron exists in the form of a ball. (For convenience, we shall express the ball of charge and material as the ball of charge.)

The proton possesses all the properties as the electron possesses. Hence, the ball of charge and the ring of magnetism of the proton also spin with frequencies ω_{PM} and ω_{PC} respectively in directions opposite to each other. It is the special characteristic of the special structure of proton that keeps the proton spinning persistently.

The proton possesses frequency of spin motion ω_P and linear velocity v_P along the direction of its spin angular momentum (L_S) in the same manner the electron possesses ω_E and v_E along the direction of its spin angular momentum (L_S). Also, the μ_S the proton possesses is generated due to the spin motion of its ring of magnetism, and occurs along the direction of spin angular momentum of its ring of magnetism (L_{SM}).

The occurrence of the linear velocity of the proton (v_P) along the direction of L_{SM} is not possible because of the large mass of its ball of charge (about 2×10^3 times), as compared to that of the ball of charge of electron.

3.3 Determination of the special structure of neutrons

See Sec. 2, Ref. 8.

3.4 How the special characteristic in electrons, protons, and neutrons, caused by their special structures, keeps them spinning persistently

As electrons and protons spin persistently without a source of infinite energy, their charge and magnetism remain intact, and are not utilized during the spinning of the electron and proton, which can only be possible if the ball of charge and the ring of magnetism of the electron, as well as the proton, both spin in opposite directions to each other. As the direction of the spin magnetic moment of the ring of magnetism (occurring along the direction of the spin angular momentum of the ring of magnetism), and the direction of the spin electric moment of the ball of charge (occurring along the direction of the spin angular momentum of the ball of charge) of the electron, together with the proton, occur in opposing directions, in this situation, the interaction between their fields takes place in such a way that, during their spin motion, there is no energy- neither electric (i.e., charge) nor magnetic (i.e., magnetism), emanating from the electron. Similarly, as far as we know, when two bar magnets are placed in parallel to each other, with their opposite poles one upon the other (i.e., when their magnetic moments lie in opposing directions to each other), the interaction between their magnetic fields takes place such that their magnetism remain intact, and do not decay. If the bar magnets are placed in any other position, their magnetism does not remain intact, and instead starts to decay, and vanishes after some time. There may some degree of doubt surrounding the electric moment of both the electron and proton as there is no evidence of its occurrence; nevertheless, this concept cannot be ruled out.

Regarding how the special characteristic in neutrons, caused by their special structures, keeps them spinning persistently, see Sec. 2.1, Ref. 8.

4. IMPORTANCE OF THE DETERMINED PURPOSE, SPECIAL STRUCTURES, AND THE SPECIAL CHARACTERISTICS

4.1 Importance of the determined purpose

The effect of the determined purpose as to why electrons, nucleons, and all other particles possess spin motion (see Sec. 2, Ref. 1) enables us to obtain a very clear and complete explanation of all the phenomena related to them. Below is a list of some of the related important phenomena included in this study: 1- Phenomenon of the interference and diffraction of photons and electrons (see Sec. 3.1, Ref. 1); 2- Phenomenon of spectroscopy (see Sec. 3.2, Ref. 1); 3- Phenomenon of transmittance T = finite for particles possessing energy $E < V_0$, where V_0 is the energy of the potential barrier (see Sec. 3.3, Ref. 1); 4- Decrease in the rate of increase in velocity of the accelerated electron after attaining its relativistic velocity (see Sec. 3.4, Ref. 1); 5- Phenomena of: i- acquiring the elliptical orbits by the orbiting electrons despite moving in the spherically symmetric field; ii- conservation of energy, momentum, spin angular momentum of the orbiting electrons during their orbital motion along their elliptical orbits (see Sec. 3.5, Ref. 1)..

4.2 Importance of the determined special structures of electrons and nucleons

The effect of the determined structures of electrons, protons, and neutrons, their properties of electric and magnetic fields, together with the effect of the determined purposes as to why they possess persistent spin motion (see Sec. 2, Ref. 9) enable us: 1- to determine a new force with the characteristics of nuclear force and both attractive and repulsive components (see Sec. 3.1, Ref. 9); 2- to give very clear and complete explanation of all the phenomena, properties and effects, related to them, generated in their systems, for example, in their beams and electric current carrying substances (see Sec. 3.2, Ref. 9), in persistent current carrying substances at their superconducting state (see Sec. 3.3, Ref. 9), in deuterons, alpha particles and nuclei (see Sec. 3.4, Ref. 9); 3- to give very clear and complete explanation of the structures and properties of their systems, for instance, deuterons, alpha particles and nuclei (see Sec. 3.4, Ref. 9).

4.3 Importance of the special characteristics in electrons and nucleons

The determined special characteristics in electrons and protons, caused by their special structures, enable us to resolve a number of important and challenging problems. For example:

1. Why and how neutrons survive for about 15 minutes (the mean lifetime of a neutron) before then decaying, while the rest of the unstable elementary particles decay within a fraction of a second (see Sec. 2, Ref. 8).
2. Why and how neutrons have both unstable and stable states, while the rest of all the elementary particles have only one state, which is either stable or unstable (see Sec. 2, Ref. 8).
3. How neutrons become stable in their systems, for example, deuterons, alpha particles, and nuclei (see Sec. 2, Ref. 8), while in their free state, they are unstable.
4. How neutrons possess a magnetic moment = - 0.00966236×10^{-24} J/T (see Sec. 3.1, Ref.8).
5. How and why electrons are emitted from the nuclei during β decay, despite the belief that the electrons do not reside inside the nuclei (see Sec. 3.3, Ref. 8).
6. Why and how the energy of the emitted β particles varies in the form of a continuous energy spectrum (see Sec. 3.4, Ref. 8).

7. Why and how neutrons have a high penetration power and distinguishable low and high-energy ranges (see Sects. 3.5 and 3.6, Ref. 8).
8. The reality of positrons, what they are, and how they are produced (complete information shall in the following section).

5. IMPORTANCE OF THE DETERMINED PURPOSE AND SPECIAL STRUCTUR OF ELECTRONS IN OUR PRACTICAL LIFE

As, due to the spin motions of the ball of charge and ring of magnetism of the electron in opposing directions, a linear velocity v_E is generated in it, the magnitude and the direction (forward or backward) of which (v_E) varies, as the situation arises by variation in ω_{EC} and ω_{EM} of the electron, this technique can be applied in order to generate linear velocity (v) in the systems, to which we supply energy to generate v. And the magnitude and direction (forward or backward) of their v can be varied by variations in ω_{EC} and ω_{EM} of the systems.

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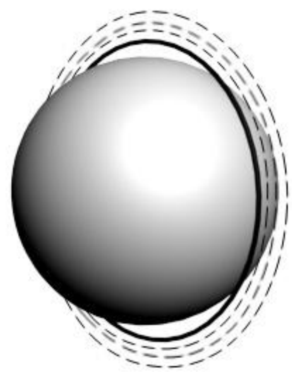
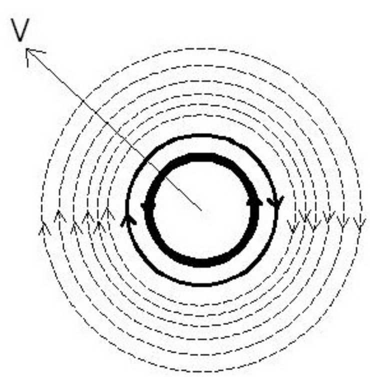
FIGURE CAPTIONS

Fig. 1: (a) Spherical ball, dark, solid line circle, and concentric broken line circles respectively represent the charge, magnetism, and magnetic field of an electron. (b) Transverse cross-sectional view of an electron, where, in order to introduce arrow marks with the ball of charge to show the direction of its spin motion, the ball of charge has been shown by a dark, thick, solid, line circle in place of a dark disc.



(a)



(b)

Fig. 1