Why and how electrons and nucleons possess persistent spin motion

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Because all electrons, nucleons, and other particles or quanta (because quantum mechanics is applied to all particles, these should be known as quanta) undergo a persistent spin motion without having any source of infinite energy, they should have a unique structure that provides their persistent spinning, as well as their other properties that they display. In addition, there should be some reason or purpose why they show a persistent spin motion, because, in nature, nothing occurs without a reason or purpose. At present, research on this topic attempts to determine how electrons, nucleons, and other particles possess the property of persistent spin motion and other properties through their unique structures as well as the purpose why they have such persistent spin motion. The results of these determinations provide the knowledge of a new force possessing the characteristics of nuclear force and both attractive and repulsive components, and provide very clear and complete explanations of:1) all the phenomena; 2) all the properties and effects of their systems; and 3) structures of their systems, e.g., deuterons, alpha particles, and nuclei; those are generated due to these particles.

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1 Introduction

As we know, in nature, nothing occurs without a reason or purpose. For example, our hearts persistently beat without having a source of infinite energy, which does not happen without a reason because an important reason exists as to why our hearts beat, in addition to why they have a unique structure that provides their persistent beating, as well as their other properties that they display. Therefore, because all electrons, nucleons, and other particles or quanta (quantum mechanics is applied to all particles; thus, they should be known as quanta) possess a persistent spin motion without having any source of infinite energy, some reason or purpose should exist why they show a persistent spin motion. In addition, such quanta should have a unique structure that provides their persistent spinning, as well as their other properties that they display.

Further, as we know, all phenomena or activities related to our hearts, e.g., continuous blood circulation in our bodies, are the consequences of the purpose behind the persistent beating of our hearts, their unique structure, and their properties. Similarly, all the phenomena or activities related to electrons, nucleons, and other particles should have been the consequences of the purpose behind their persistent spin motion, their unique structures, and their properties.

Therefore, the purpose why all electrons, nucleons, and other particles display a persistent spin motion (Section 2), and unique structures of electrons and nucleons (Section 3) have been determined. The results of these determinations provide the knowledge of a new force which possesses the characteristics of nuclear force and both attractive and repulsive components (see Section 4.2), and provide very clear and complete explanations of: 1) all the phenomena (see Section 4.1); 2) all the properties and effects of their systems, e.g., their beams, electric current-carrying substances, persistent current-carrying substances in the superconducting state, deuterons, alpha particles, and nuclei (see Section 4.2); and 3) structures of their systems, e.g., deuterons, alpha particles, and nuclei (see Section 4.2); those are generated due to these particles.

Currently, electrons, nucleons, and other particles are assumed to possess wave characteristics, and all phenomena related to them are assumed to occur because of their dual nature (wave and particle characteristics). Their wave nature is assumed because this property 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 considered to be true (see Section 1.1, [1] for verification), and the interference and diffraction phenomena of electrons and photons cannot occur because of their wave nature (see Section 1.2, [1] for verification).

2Determination of the purpose why electrons and nucleons possess persistent spin motion

The spin motion of electrons, nucleons, and other spinning particles generate the following two properties in them.

2.1 First property

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

If the frequency of the spin motion of such particle is increased by some factors, a point will be reached when the particle starts moving along its L_S direction. Moreover, if the frequency of the spin motion of the particle is increased further, the particle velocity continues to increase in accordance with the following equation [2]:

$$\mathrm{v}^2 = h\,\omega / m \qquad (1)$$

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

Because all particles such as electrons, protons, and neutrons possess persistent spin motion, that (spin motion) forces them to continuously move with linear velocity (v). Therefore, they are always found in a state of motion, which is oriented along the directions of their respective L_S (see [3] for verification), and their linear velocity (v) varies in the same manner as the frequency of their spin motion (ω) varies, as shown in Eq. (1).

2.2 Second property

Because a particle obtains kinetic energy (E_K) and linear momentum (p_{LIN}) due to its linear motion, it similarly acquires spin energy $E_S = h\omega/2$ (see Section II, [2]) and spin momentum $p_S = h\omega/\mathrm{v}$ (see Section II, [2]) owing to its spin motion. (For verification that the particle acquires p_S due to its spin motion, see Section I C, [2].)

Therefore, electrons, nucleons, and all particles possess motional energy (E_M) = $E_K + E_S$ and motional momentum (p_M) = $p_{LIN} + p_S$. During their motion, their E_M , p_M , and L_S are conserved but not their E_K and p_{LIN} . [To understand how E_M , p_M , and L_S of the electrons and nucleons are conserved, see Section 3.1. To verify that their p_M values are conserved, see Section I D, [2].] Because of the conservation of their E_M , p_M , and L_S , no violation of the laws arises with regard to the conservation of energy, momentum, and spin angular momentum during their motion under any condition. We present the following as examples.

1. During the motion of an accelerated electron by a large voltage (e.g., in Bertozzi's experiment [4]), when the rate of increase in its velocity starts decreasing (which causes a decrease in its E_K and p_{LIN}) after it attains relativistic velocity, the rate of increase in the frequency of its spin motion starts increasing, which in turn causes an increase in its E_S and p_S . The increase in E_S and p_S of the electron compensates the decrease in its E_K and p_{LIN} ; thus, E_M and p_M of the electron are conserved. (For verification that after the electron has attained relativistic velocity, its frequency of spin motion increases in order to conserve its E_M and p_M , see Sections IV C1 and IV C2, [2].) The increase in the rate of increase in the frequency of

the spin motion of the electron occurs in such manner (Section 3.1) that the law of conservation of its L_S is not violated.

Currently, we believe that when the rate of increase in the electron velocity starts decreasing (which causes a decrease in its E_K and p_{LIN}) after attaining its relativistic velocity, its moving mass (m_{mov}) starts to increase to conserve its E_K and p_{LIN}. However, this cannot be true (for the justification, see Section 3.4.1, [5]). The equation for the moving mass of an electron $\mathrm{m_{mov}} = \mathrm{m_e} / \sqrt{(1 - \mathrm{v}^2 / c^2)}$ (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. m_{mov} is actually the effective mass (m_{eff}) of the electron, which is obtained as a result of the superposition of the effect of the spin motion of the electron on its m_e. The relativistic kinetic energy $E_K = [m_e \, \mathrm{c}^2 / \sqrt{(1 - \mathrm{v}^2 / c^2)}] - m_e \, c^2$ and relativistic linear momentum $p_{LIN} = m_e \mathrm{v} / \sqrt{(1 - \mathrm{v}^2 / c^2)}$ of the electron are its E_M $(= m_{\mathrm{eff}} \, \mathrm{v}^2/2)$ and p_M $(= m_{\mathrm{eff}} \, \mathrm{v})$, respectively, which are obtained from 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 on how these relationships are obtained, see Section IV C, [2]).

2. During the motion of the electron along its elliptical orbit, because the velocity of the electron varies, E_K and p_{LIN} of the electron also accordingly vary. Then, ω of the electron varies in such a manner that the variations caused in its E_S and p_S due to the variation in its ω, may balance the loss or gain that occurs in its E_K and p_{LIN} due to the variation in its velocity. Thus, E_M and p_M of the electron remain conserved throughout its orbital motion. The variation in the frequency of the spin motion (ω) of the electron occurs in such manner (see Section 3.1) that the law of conservation of its L_S is not violated.

Note: During the motion of the electrons along their elliptical orbits as well as during their motion after attaining relativistic velocity, variation between their v and ω does not occur according to Eq. (1) but rather occurs according to the following equation:

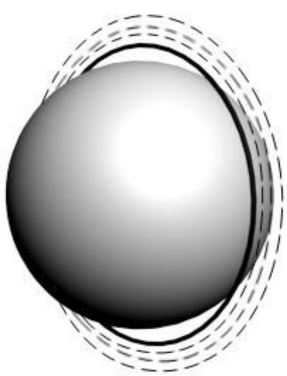
$$\mathrm{v}^2 = h\,\omega / m_{\mathrm{eff}} \; = h\,\omega / m_{\mathrm{mov}} \qquad (2)$$

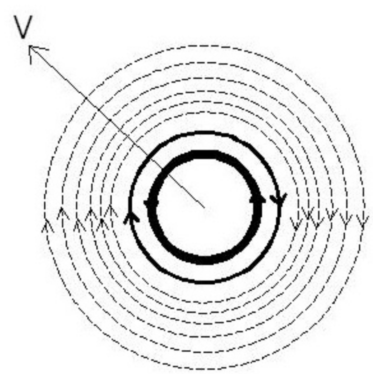
3. Determination of the unique structures of electrons, protons, and neutrons

3.1 Determination of the unique structure of electrons

The current concepts regarding the structure of an electron, which is similar to a ball of electrical charge ($-e$), and its magnetic field, spin magnetic moment (μ_S), and other properties are obtained from the spin motion of its ball of charge are incorrect (for its proof, see Section 1, [6]).

An electron has a unique structure. It also possesses a degree of magnetism owing to its nature. In the same manner, an electron possesses a charge ($-e$). The magnetism occurs in the form of a circular ring, as shown by the dark solid-line circle around the charge of the electron, which (charge of the electron) has been shown by a spherical ball in Fig. 1(a), e.g., similar to the rings around planet Saturn. Surrounding the ball of charge of the electron is an electric field (not shown in Fig. 1), and around the ring of magnetism of the electron exists the magnetic field, which is shown by the circles with broken lines in Fig. 1(a). The ring of magnetism and the ball of charge of the electron both spin with frequencies ω_{EM} and ω_{EC} , respectively, but in opposite directions, as shown by the opposing arrows in Fig. 1(b); the ball of charge is represented by a thick dark circle, and the ring of magnetism is represented by a thinner dark circle.





(a) (b)

Fig.1. (a) The spherical ball, dark solid-line circle, and concentric broken-line circles represent respectively the charge, magnetism, and magnetic field of an electron. (b) Transverse cross-sectional view of an electron where the ball of charge is indicated by a dark, thick, and solid-line circle, magnetism by a dark, thin, and solid-line circle, and magnetic field by broken-line circles with arrows to show the directions of their spin motion.

The opposing spin motions of the ring of magnetism and ball of charge of the electron is a unique characteristic caused by the unique structure of electrons. Under this condition, their fields interact (electromagnetic interaction) with each other in a manner that their spin motion persists (for further information, see Section 3.4).

When the ring of magnetism and ball of charge of the electron spin with frequencies ω_{EM} and ω_{EC}, respectively, due to their spin motions, linear velocities v_{EM} and v_{EC}, respectively, are generated in them along the directions of their respective spin angular momentum L_{SM} and L_{SC}, according to Eq. (1). Consequently, the electron acquires linear velocity $\mathrm{v}_{\mathrm{E}}\,(= \mathrm{v}_{\mathrm{EC}} - \mathrm{v}_{\mathrm{EM}}$ or $= \mathrm{v}_{\mathrm{EM}} - \mathrm{v}_{\mathrm{EC}})$along the L_S direction. Further, corresponding to velocity v_{E}, the frequency of the spin motion (ω_E), which is obtained from Eq. (1), can be assumed as the frequency of the spin motion of the electron. During the electron motion along its elliptical orbits or after attaining relativistic velocity, ω_E is obtained corresponding to its linear velocity $\mathrm{v}_{\mathrm{E}}\,(= \mathrm{v}_{\mathrm{EC}} - \mathrm{v}_{\mathrm{EM}})$ according to Eq. (2), because, during that its v_{E} varies (decreases or increases in former case, and decreases in later case).

During the electron motion along its elliptical orbits or after attaining relativistic velocity, to conserve its E_M, p_M ,and L_S, it contracts or expands. Subsequently, its radius (r) decreases or increases, which causes a consequential decrease or increase in its moment of inertia $I\,(= \mathrm{m_e}\, r^2)$. The decrease or increase in I of the electron causes a decrease or increase in $L_S\,(= I\, d\theta/dt$, where $d\theta/dt$ is the angular velocity of its spin motion) of the electron. Therefore, to conserve L_S of the electron, $d\theta / dt$ of the electron is increased or decreased, which causes an increase or decrease in ω of the electron according to Eq. (2). The increase or decrease in ω causes an increase or decrease in the electron E_S and p_S , which respectively conserves E_M and p_M by compensating the decrease or increase in its E_K and p_{LIN} caused due to the variations (decrease or increase) in its $\mathrm{v_E}$. The expansion or contraction concept of the electron is considered difficult to believe, but it cannot be neglected. As the proton size shrinks [7], the electron size can also shrink. Second, photons, which are bundles (quanta) of radiation energy and behave similar to particles (Section 2, [8]), are known to be emitted from the orbiting electrons. This condition can only be possible if during electrons excitation, they are filled with radiation energy and they expand. After their excitation, they suddenly contract (shrink), and by collectively emitting their contained radiation energy during their excitation in the form of photons, they transit back (for detailed information, see Section III B, [2]). The number of times an orbiting electron expands and contracts during its one complete orbital motion along its elliptical orbit is equal to the number of photons emitted from that orbiting electron (see Sections III I, [2] for detail information). The frequencies of the spin motion of the emitted photons (see Sections III E, and III I, [2] for detail information) and the levels of radiation energy (see Sections III F, and III I, [2] for detail information) that they contain depend on the different positions where the orbiting electron emits the photons during its orbital motion. These photons comprise the number of fine lines(see Sections III K, III K 1a, and III K 2a, [2])in the fine structure of a spectral line, their (fine lines) frequencies (see Sections III K, III K 1b, and III K 2b, [2]), and their intensities(see Sections III K, III K 1c, and III K 2c, [2]), in accordance with the number of photons, their spin-motion frequencies, and the levels of radiation energy that they contain. (For complete information, see Section III, [2]).

When $\mathrm{v_{EC}}$ [generated in the ball of charge along its L_{SC} direction due to its ω_{EC}] $>$ $\mathrm{v_{EM}}$ [generated in the ring of magnetism along its L_{SM} direction due to its ω_{EM}], the electron acquires $\mathrm{v_E}$ along the L_{SC} direction (i.e., L_S of the electron lies along the L_{SC} direction), and when $\mathrm{v_{EC}} < \mathrm{v_{EM}}$, the electron acquires $\mathrm{v_E}$

along the L_{SM} direction (i.e., L_S of the electron lies along the L_{SM} direction).The first condition (i.e., the electron acquires v_E along the L_{SC} direction) normally occurs. The second condition (i.e., the electron acquires v_E along the L_{SM} direction) occurs very rarely and under special circumstances, e.g., as created in radioactive nuclei {see bullet b) of Section 3.6.2, [9]}. The occurrence of v_E in both forward (along the L_{SC} direction) and backward (along the L_{SM} direction) directions is of great importance. It enables us to develop a new neutron model (see Section 2, [10]), which provides very clear and complete explanation:

1) of all the properties of neutrons that they display, including properties which have never been explained before (see Section 3, [10]);

2) of all the properties generated due to nucleons in deuterons, alpha particles, and nuclei, including properties which have never been explained before (see Sections 3.1, 3.2, 3.3, 3.4, 3.5, and 3.6, [9]);

3) of the structures of deuterons, alpha particles, and nuclei (see Sections 3.1, 3.2, 3.3, 3.4, and 3.5, [9]).

The property of spin magnetic moment (μ_S) of the electron is generated by the spin motion of its ring of magnetism and occurs along the L_{SM} direction. Because v_E normally occurs along the L_{SC} direction and L_{SC} occurs opposite the L_{SM} direction, v_E occurs opposite the μ_S direction.

3.2 Determination of the unique structure of protons

A proton has the same amount of charge ($+e$) as the electron ($-e$); however, the proton is approximately 2×10^3 times more massive than the electron, which means that the proton possesses something more—probably, some materials—along with its charge ($+e$). Its charge and materials most likely exist together in the form of a ball, similar to that of the electron. (For convenience, we shall express the charge and material as a ball of charge.)

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

The frequency of the spin motion of the proton is denoted as ω_P , and its linear velocity along the direction of its spin angular momentum (L_S) is denoted as v_{P} , similar to the electron frequency of the spin motion (ω_E) and linear velocity (v_{E}) along its L_S direction. The property of spin magnetic moment (μ_S) of the proton is generated by the spin motion of its ring of magnetism and occurs along the L_{SM} direction.

Occurrence of proton linear velocity v_{P} along the L_{SM} direction does not happen to be possible because of the large mass of its ball of charge (approximately 2×10^3 times that of the ball of charge of the electron). Proton linear velocity v_{P} occurs only along the L_{SC} direction

3.3 Determination of the unique structure of neutrons

A neutron is a combination of an electron and a proton, which (combination) happens to be such that the neutron behaves as a single particle in nuclei as well as outside the nuclei, similarly, as a proton behaves. This combination keeps neutrons persistently spinning and provides all the properties that the neutron displays. For detailed information, the readers are referred to Ref. [10].

3.4 Why and how the opposing spin motions of the ring of magnetism and ball of charge of the electron as well as of the proton keep them persistently spinning

Because the electrons and protons persistently spin without a source of infinite energy, their charge and magnetism remain intact and are not utilized during their spinning, which can only be possible if the balls of charge and the rings of magnetism of the electron as well as of the proton spin in opposite directions. Because then the direction of the spin magnetic moment of the ring of magnetism (which occurs along the direction of its spin angular momentum) and that of the spin electric moment of the ball of charge (which occurs along the direction of its spin angular momentum) of the electron as well as of the proton are opposite. Under this condition, the interaction between their fields occurs in such a manner that during their spin motion, no energy [either electric (i.e., charge) or magnetic (i.e., magnetism)] emanates from the electron as well as from the proton. As we know, when the directions of the magnetic moment of two bar magnets are opposite to each other (i.e., when two bar magnets are placed one upon the other and parallel to each other with their opposite poles oriented opposite each other), interaction between their fields takes place such that their magnetism remain intact and do not decay. If the directions of the magnetic moment of two bar magnets are not opposite to each other (i.e., if the bar magnets are oriented in any other position), their magnetism do not remain intact. Instead, they start to decay and vanish after some time. Some doubts surround the electric moment of both the electron and proton because no evidence of its occurrence is available. Nevertheless, this concept cannot be ruled out.

For the explanation on how the unique characteristic of neutrons caused by their unique structures keeps them persistently spinning, see Section 2.1, [10].

4Importance of the determination of the purpose, unique structure, and unique characteristics of electrons and nucleons

4.1 Importance of the determination of the purpose

The results of the determination of the purpose why electrons, nucleons, and other particles possess the property of persistent spin motions {see bullets 1), and 2) of Section 2, [5]} allow us to obtain very clear and complete understanding of all the phenomena generated due to the property of their persistent spin motion, including phenomena which were previously poorly explained or unexplained. The following list shows some of the phenomena of particular importance included in this study:

1) Interference and diffraction of photons and electrons (Section 3.1, [5]).

2) Spectroscopy (Section 3.2, [5]).

3) Transmittance T is finite for particles possessing energy $E < V_0$, where V_0 is the energy of the potential barrier (Section 3.3, [5]).

4) Reduction in the rate of increase in velocity of the accelerated electron after attaining its relativistic velocity (Section 3.4, [5]).

5-i) Acquisition of elliptical orbits by orbiting electrons despite moving in a spherically symmetric field (Section 3.5.1, [5]).

5-ii) Conservation of energy, momentum, and spin angular momentum of the orbiting electrons during their orbital motion along their elliptical orbits (Section 3.5.2, [5]).

4.2 Importance of the determined unique structures and properties of electrons and nucleons

The results of the determination of the unique structureof electrons, and nucleons {see bullets i), ii), and iii) of Section 2, [11]}, together with the results of the determination of the purpose why electrons and nucleons possess the property of persistent spin motions {see bullets 1) and 2) of Section 2, [11]}, provide us the following:

1) Knowledge of a new force which possesses the characteristics of nuclear force and both attractive and repulsive components (Section 3.1, [11]).

2) Clear and complete explanation of all the properties, and effects generated due to their properties in their systems, e.g., their beams, electric current-carrying substances (Section 3.2, [11]), persistent current-carrying substances in the superconducting state (Section 3.3, [11]), deuterons, alpha particles, and nuclei (Section 3.4, [11]), including numerous very challenging properties which could have never been explained before.

3) Clear and complete understanding of the structures of their systems, e.g., deuterons, alpha particles, and nuclei (Section 3.4, [11]).

5 Conclusion

As we know, properties of a person depend upon his physical and mental structures, and a work performed by him depends upon his properties and condition under which the work is performed. In the same manner, properties of electrons, and nucleons {see bullets 1), and 2), and bullets i), ii), and iii) of Section 2, [11]) should depend upon their structures, and 1) all the phenomena generated due to them; 2) all the properties and effects generated due to them in their systems; and 3) the structures of deuterons, alpha particles, and nuclei; should depend upon their properties. Therefore, if models for electrons and nucleons are developed, their models should explain their all the properties, and their properties should explain all the phenomena, and all the properties and structures of their systems, generated due to them. Otherwise, their developed models, e.g., the current models, cannot be true. The structures of electrons, protons, and neutrons, which were determined or presumed before, were incorrect (see Section 1, [6] for structure and properties of electrons, and Section 1, [10] for structure and properties of neutrons). Consequently, there are numerous properties of neutrons, which were unexplained before (see Section 5, [10]), and numerous phenomena(see Section 1, [5]), numerous properties of their systems as listed in Sections 3.2, and 3.4 [11], several properties of the list of Section 3.3, [11], and structures of deuterons, alpha particles, and nuclei, which were unexplained before. Further, the phenomena, and properties, which were explained before, if we examine their rigorous mathematical proofs, in them, numerous logically and practically unbelievable assumptions have been accepted in order to arrive at the desired results (see Section 1, [5], and sections 3.1.1, and 3.3.1, [11]).

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