

The Truth of Quantum Entanglement

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[Abstract]

A new model of electron and photon polarization processes based on Yangton and Yington Theory are proposed. Quantum energy states of the electrons and photons in each spin mode are considered as the Hidden Variables of the electrons and photons. Polarization energies dependent on the polarization angles are added to each electron and photon through polarization processes. Subject to the polarization energy and threshold energy dependent on the polarization angle, electrons and photons can stay either at the same spin mode or transform to the opposite spin mode through the polarization process. These field dependent quantum energy states generated through polarization processes are called Field Dependent Hidden Variables. The probability of polarization transformation is calculated as a function of polarization angle which matches with the ratio of polarization transformation measured in experiments.

Furthermore, according to Quantum Entanglement, a pair of electrons (photons) can be generated together with two entangled quantum energy states (Hidden Variables) having the same quantum energy but of the opposite spin modes. When a pair of entangled electrons (photons) passing through a magnetic (optical) polarizer, the polarization angle and polarization energy are the same for both electrons (photons). However, subject to the polarization energy and threshold energy dependent on the polarization angle, the electron (photon) pair can stay still entangled in either the same spin modes or transform to the opposite spin modes. This is called Field Dependent Entanglement.

For more than a century, quantum entanglement was kept one of the biggest mysteries in modern physics. Not only has it been misinterpreted by non-existing quantum superposition and free-will quantum entanglement, but also it creates a big conflict with the limit of speed and local realism. In this paper, based on Yangton and Yington Theory, quantum energy states are proposed as the Hidden Variables of electrons and photons. The correlations between polarization energy, threshold energy and polarization angle are carefully studied, and quantum entanglement is successfully explained. As a result, superposition and free-will entanglement are not true. Instead, Hidden Variables do exist, and Bell's Inequality is always obeyed.

(Keywords)

Quantum Entanglement, Quantum Superposition, Hidden Variable, Bell's Inequality, EPR Paradox, Yangton and Yington Theory, Wu's Pairs, String Structures, Electron Spin, Photon Spin, Quantum Energy State, Electron Polarization, Photon Polarization, Normalization, Field Dependent Hidden Variable, Field Dependent Entanglement.

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I. Yangton and Yington Theory

Yangton and Yington Theory [1] is a hypothetical theory based on a pair of superfine Yangton and Yington antimatter particles with built-in inter-attractive Force of Creation circulating against each other on an orbit. These pairs of Yangton and Yington circulating particles are named "Wu's Pairs" (Fig. 1) which is considered as the building blocks of all matters in the universe.

Yangton and Yington Theory can explain that elementary subatomic particles such as quarks, electrons, neutrinos, gluons, photons and gravitons are basic string structures composed of Wu's Pairs with String Forces [2]. It complies very well with Quantum Field Theory [3] and String Theory [4]. In addition, Four Basic Forces including electromagnetic, weak, strong and gravitational forces are made of String Forces induced from Force of Creation. It agrees with Unified Field Theory [5].

Furthermore, Yangton and Yington Theory can bridge Quantum Theory with General Relativity [6], also interprets and correlates space, time, energy and matter in the universe. Therefore, it is believed that Yangton and Yington Theory is not only a Unified Field Theory but also a theory of everything.

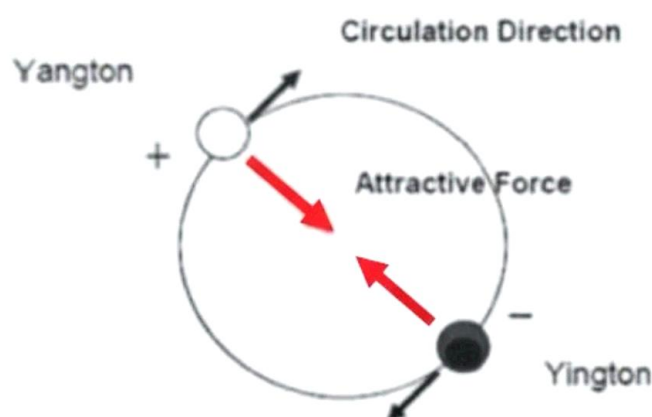


Fig. 1 Wu's Pair - a Yangton and Yington circulating pair.

II. Photon – A Free Wu's Pair

When Wu's Pair is released from a substance, it becomes a free particle moving in the normal (axial) direction of Yangton and Yington circulation plane. It is known as "Photon". Photon travels in space at a constant Absolute Light Speed 3×10^8 m/s (dependent on the gravitational field and aging of the universe at the light source), while observed at the light source. The reaction process can be represented as follows:



Where Yangton Φ Yington is Wu's Pair and $h\nu$ is photon's kinetic energy.

When photon travels, due to the circulation of Yangton and Yington (the rotation of electric dipole), electromagnetic waves can be generated along the path.

Since photon is a free Wu's Pair, it is indeed a God's Particle, which also explains why photon is the most popular particle observed in the universe.

III. Electron

When a number of Wu's Pairs come together, they can stack up to form a string or ring structures (Fig. 2) or cross each other's orbits to form a structure that is either with Yingtons circulating the Yangton center as the electrons or with Yangtons circulating the Yington center as the positrons (Fig. 3) [2].

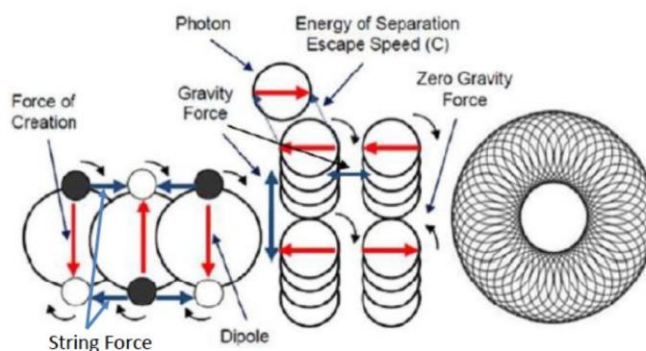


Fig. 2 Wu's Pairs stack up in a preferred direction by string force to form string and ring structures.

Because photon, a free Wu's Pair, can be either absorbed or emitted from an electron jumping between two energy levels in an atom, it is proposed that "Electron" is composed of a number of Wu's Pairs, where Yangtons are loosely confined in the center due to the compression of the centrifugal force generated by the circulation of Yingtons. Similarly, "Positron" is composed of a number of Wu's Pairs, where Yingtons are loosely confined in the center due to the compression of the centrifugal force generated by the circulation of Yangtons. Therefore, electron can have an appearance that looks like a sphere of Yingtons, and positron, on the other hand, can have the appearance looks like a sphere of Yangtons (Fig. 3).

Because of the attraction between Yangton and Yington, a strong attractive force can be generated between an electron and a positron. Also, a repulsive force can be formed between two electrons and between two positrons. These forces are named "Electrical Force". When a positron meets an electron, because of the attraction, they collide and destroy each other to release gamma ray (γ). This phenomenon is known as "Positron-Electron Annihilation" [7].

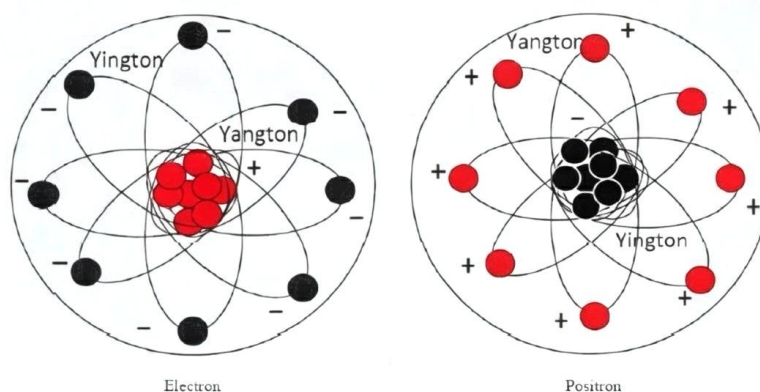


Fig. 3 Hypothetical structures of electrons and positrons.

Based on logical thinking, the structures of electron and positron are suggested as follows:

1. The attractive force between electron and positron is like that between Yangton and Yington.
2. The repulsive forces between two electrons and between two positrons are like those between two Yangtons and two Yingtons.
3. Electron must be a cluster of Yingtons, and positron must be a cluster of Yangtons.

Because Wu's pairs (Yangton and Yington pairs) are the building blocks of all matters, also Yangton and Yington cannot be separated from each other, therefore an electron can only be structured as a sphere made of Yingtons with a core of Yangtons. Similarly, a positron can only be structured as a sphere made of Yangtons with a core of Yingtons.

IV. Quantum Superposition

Quantum Superposition [8] is a fundamental principle of quantum mechanics. Any two (or more) quantum energy states can be added together ("superimposed") and the result will be another valid quantum energy state; and conversely, that every quantum energy state can be represented as a sum of two or more other distinct states. Mathematically, it refers to a property of solutions to the Schrödinger equation; since the Schrödinger equation is linear, any linear combination of solutions will also be a solution. A single electron can be represented as a wave function with superposition of two quantum energy states, spin-up and spin-down, in Schrödinger equation.

V. Quantum Entanglement

Quantum entanglement [9] is the physical phenomenon that occurs when a pair or group of particles is generated at the same time, they interact or share spatial proximity in a way such that the quantum energy state of each particle of the pair or group cannot be described independently of the state of the others, even when the particles are separated by a large distance. Measurements of physical properties such as position, momentum, spin and polarization performed on entangled particles are found to be perfectly correlated. For example, if a pair of entangled particles is generated such that their total spin is known to be zero, and one particle is found to have clockwise spin on a fixed axis, then the spin of the other particle, measured on the same axis, even instantly will be found to be counterclockwise.

VI. Quantum Paradoxes

Complying with both quantum superposition and quantum entanglement, it gives rise to two paradoxes:

(1) In quantum entanglement, the speed of communication could be infinitively fast for immediate observation by the other entangled electron at far distance. This opposes local realism, and that all speed is limited, even Einstein's Special Relativity that nothing can travel faster than light speed.

(2) Any measurement of the property of an entangled particle attains a fixed quantum energy state of the particle and results in an irreversible wave function collapse of that particle, which causes interruption of the entanglement and subsequently a random state of the other particle can be measured. This conflicts with quantum entanglement that only the entangled quantum energy state can be observed by the other particle no matter of time and location.

In contrast, according to Equation of Light Speed [10], in which light speed observed at the reference point is a vector summation of light speed observed at light source (Absolute Light Speed 3×10^8 m/s) and the light source speed observed at the reference point, therefore, light speed observed at the reference point is limited even that it can be much faster than the Absolute Light Speed (meaning that Einstein's theory "No speed is faster than light speed" is wrong). Therefore, the first paradox regarding light speed doesn't exist. Furthermore, based on Yangton and Yington Theory, quantum energy states are proposed as Hidden Variables [11] and Field Dependent Hidden Variables [12] in electrons and photons. Complying with polarization energy, threshold energy and polarization angle (polarization strength), quantum entanglement can be very well explained by Field Dependent Entanglement Theory [13], such that the second paradox between super position and quantum entanglement doesn't exist either.

VII. EPR Paradox

In 1935, Albert Einstein, Boris Podolsky, and Nathan Rosen brought up EPR Paradox [14], in which Einstein and others considered quantum entanglement to be impossible unless instant communication can be fulfilled for an infinite distance. It violates the local realism view of causality (Einstein referring to it as "spooky action at a distance") and argued that the accepted formulation of quantum mechanics must therefore be incomplete.

Furthermore, a measurement made on either of the particles apparently collapses the state of the entire entangled system instantaneously before any information about the measurement result could have been communicated to the other particle. According to quantum theory, the outcome of the measurement of the other part of the entangled pair must be taken to be random, with each possibility having a probability of 50%. However, if both spins are measured along the same axis, they are found always to be anti-correlated.

VIII. Hidden Variables

Despite the impossible solution that communication between two particles can be so fast even more than light speed, Einstein proposed a possible resolution to the paradox is to assume that quantum theory is incomplete, and the result of measurements depends on predetermined "Hidden Variables" [15]. The state of the particles being measured contains some hidden variables, whose values effectively determine, right from the moment of separation, what the outcomes of the spin measurements are going to be. This would mean that each particle carries all the required information with it and nothing needs to be transmitted from one particle to the other at the time of measurement. Also, with predetermined Hidden Variables, superposition won't exist. Einstein and others originally believed this was the only way out of the paradox, and the accepted quantum mechanical description

with a random measurement outcome must be incomplete. However, what are those predetermined “Hidden Variables” remains a mystery.

Based on Yangton and Yington Theory, quantum energy states generated by the spinning of photons and electrons can be considered as the Hidden Variables. However, these quantum energy states (Hidden Variables) are dependent on the polarization angle (polarization strength) in the polarization process rather than Einstein’s predetermined hidden variables before polarization process. This hidden variables after polarization process are named “Field Dependent Hidden Variables”. To prove the existence of Hidden Variables (Field Dependent Hidden Variables), instead of the indirect proof by complicated and confusing Bell’s Inequality, direct proof by experiments can be implemented. Based on the spin modes and polarization transformation mechanisms of photons and electrons, threshold energy of transformation dependent on the polarization angle (polarization strength) can be calculated, which should be equal to the probability of polarization transformation. Since this calculated probability of polarization transformation matches very well with the ratio of polarization transformation measured by experiments, it proves that quantum energy states are indeed the Hidden Variables.

IX. Bell’s Inequality

The weak point in EPR’s argument was not discovered until 1964, when John Stewart Bell proved by his inequality that the Hidden Variables interpretation hoped for by EPR, was mathematically inconsistent with the reality. When measurements are made on many pairs of entangled particles, statistically, if the hidden variables view were correct, then the results would always satisfy Bell’s Inequality [16]. Since a number of experiments have demonstrated that Bell’s Inequality is not satisfied, therefore it is believed that hidden variables are not true and quantum mechanics does comply with Superposition and Complementarity. However, after carefully studying, it was proved that those mathematical models and experimental results used in Bell’s Inequality analyses are incorrect [17]. In addition, many loopholes are found in the experiments, therefore, the conclusions of Bell’s Inequality Experiments are invalid. As a matter of fact, Hidden Variables do exist, and Bell’s Inequality is always obeyed.

X. Electron Spin and Entanglement

A. Dual Spins

According to Yangton and Yington Theory, electrons contain an outer shell (a shell of circulating Yingtons) and an inner core (a cluster of rotating Yangtons). It is proposed that not only the Yington shell can circulate Yangton core (revolution), but also both Yangton core and Yington shell can also do self-spin either in the same direction or opposite directions. This system is named “Dual Spins” (revised from [11][18]). In Dual Spins System, there are two major categories: “Up Spin” and “Down Spin”. Up Spin means that Yington shell revolution and Yangton core self-spin are in the same direction, and Down Spin means that they are in the opposite directions. In addition, there are two minor categories: “Parallel Spin” and “Anti-parallel Spin”. Parallel Spin means that both Yington shell self-spin and Yangton core self-spin are in the same direction, and Anti-parallel Spin means that Yington Shell self-spin and Yangton core self-spin are in the opposite directions. Together, there are four spin modes: Up-Up (U_u) for Up Spin and Parallel Spin, Up-Down (U_d) for Up Spin and Anti-parallel Spin, Down-Down (D_d) for Down Spin and Anti-parallel Spin, and Down-Up (D_u) for Down Spin and Parallel Spin (Fig. 4) (revised from [11][18]).

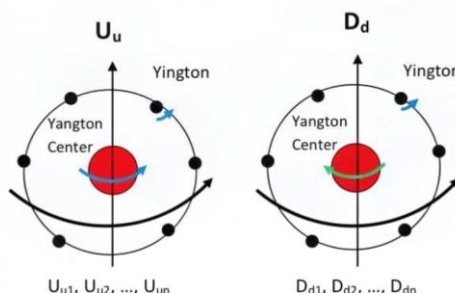


Fig. 4 Electron Spin contains Four Modes: (1) Up Spin: UP-UP (U_u) and UP-Down (U_d) modes, (2) Down Spin: Down-Down (D_d) and Dow-Up (D_u) modes. Each mode contains equal amount of energy states.

B. Quantum Energy States

In an electron, Yington Shell circulating Yangton Core can generate a group of quantum energy states in different spin modes. Each quantum energy state can be represented by a composite code, for example U_u5 means the 5th energy level (such as the quantum energy of the electron that moves in a revolution loop with 5 standing waves) in Up-Up (U_u) Mode. According to Pauli Exclusion Principle, an electron can only occupy one quantum energy state in the spin mode at a time, therefore a pair of entangled electrons should have the same quantum energy but opposite spin directions such as U_u5 and D_d5 . In addition, all spin modes should have equal amount of quantum energy states. Furthermore, it is proposed that up and anti-parallel spin mode U_d has higher energy than that of up and parallel spin mode U_u , as is D_u to D_d . Also, all electrons prefer to stay in a lower energy quantum energy state rather than the higher energy quantum energy states.

All the quantum energy states of an electron in various spin modes can be considered as the Hidden Variables of the electron. Since each electron produced from a coherent electron generator or magnetic polarization process (polarization measurement) occupies randomly a quantum energy state (Hidden Variable) in the coherent Up Spin mode (U_u or U_d) at equal probability, therefore, the probability of those electrons having quantum energies in a specific range of quantum energy states is equal to the ratio of the specific range over the total range of quantum energy states. This probability is also equal to the ratio of the electrons found in the specific range over the total range of quantum energy states observed in experiments [11][13]. As a result, the consistency between the calculations and experiments has proven that Hidden Variables indeed exists, and Quantum Superposition Theory is false after all [13][17].

C. Magnetic Polarization Transformation

When coherent electrons pass through an external magnetic field (magnetic polarizer), their internal magnetic field is forced to follow the external magnetic field such that electrons in the coherent Up spin mode can be converted to down-spin mode depending on the polarization strength (magnetic polarization angle) between the initial internal magnetic field and the external magnetic field.

Fig. 5 (revised from [11][18]) shows the mechanism of magnetic polarization in an infinitesimal time during magnetic polarization process (magnetic polarization measurement), where B_1 is the initial internal magnetic field of the electron, B is the internal magnetic field, B_2 is the external magnetic field applied by a measurement device, and Θ is the angel between B and B_2 .

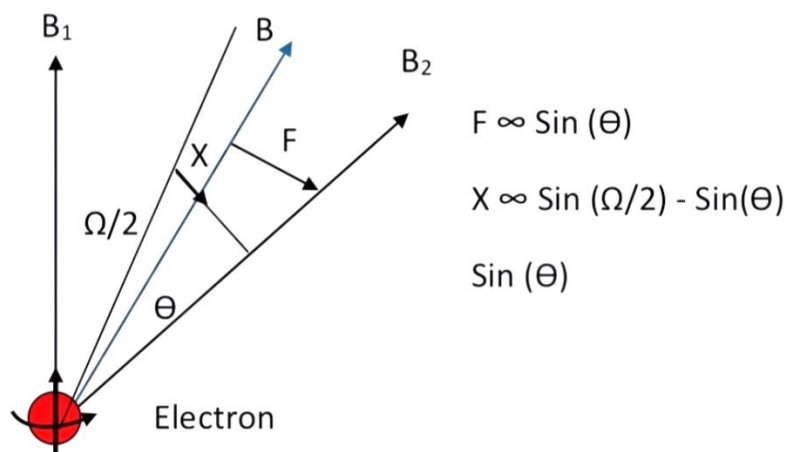


Fig. 5 Force and energy applied on an electron from an external magnetic field during magnetic polarization process.

In the beginning, the internal magnetic field B of the electron spontaneously shifts to the middle angle direction ($\Omega/2$) between the initial internal magnetic field B_1 of the electron and the external magnetic field B_2 without changing the initial quantum energy state of the electron. Subsequently, the internal magnetic field B of the electron moves from the middle angle direction ($\Omega/2$) to the external magnetic field B_2 . Finally, a fixed amount of Magnetic Polarization Energy dependent on B_1 , B_2 and polarization angle (Ω) is added to the electron [11].

Finally, subject to the total quantum energy in the electron, electron can stay either in the same Up spin mode or flip to the Down spin mode.

During the magnetic polarization process, when the internal magnetic field B of the electron moves to position X , where $X = k_1 B_1 (\sin(\Omega/2) - \sin\Theta)$ (revised from [11][18]) at angle Θ from the external magnetic field B_2 , an infinitesimal energy (dE) is added to the electron which can be calculated as follows:

$$dE = F dX$$

$$F = k_2 B_2 \sin\Theta$$

$$X = k_1 B_1 (\sin(\Omega/2) - \sin\Theta)$$

$$d\sin\Theta = \cos\Theta d\Theta$$

$$dX = -k_1 B_1 d\sin\Theta = -k_1 B_1 \cos\Theta d\Theta$$

$$dE = F dX = -k_1 B_1 k_2 B_2 \sin\Theta \cos\Theta d\Theta$$

Where B_1 is the initial magnetic field in the electron and B_2 is the external magnetic field applied on the electron, k_1 and k_2 are constants. Θ is the angle between the internal magnetic field B and the external magnetic field B_2 .

Therefore, with polarization angle Ω between B_1 and B_2 , the total magnetic polarization energy ΔE added to the electron as Θ changes from $\Omega/2$ to 0° , can be calculated as follows:

Because

$$\sin\Theta \cos\Theta d\Theta = 2d(\sin^2\Theta)$$

$$\Delta E = \int dE = \int -k_1 k_2 B_1 B_2 \sin\Theta \cos\Theta d\Theta = \int -2k_1 k_2 B_1 B_2 d(\sin^2\Theta)$$

$$K = 2k_1 k_2 B_1 B_2$$

Therefore,

$$\Delta E = K (\sin^2(\Omega/2) - \sin^2(0^\circ))$$

Because

$$\sin^2(0^\circ) = 0$$

Therefore,

$$\Delta E(\Omega) = K \sin^2(\Omega/2)$$

Since the highest quantum energy state in the Up Mode of the initial electrons with internal magnetic field B_1 in S direction is E_{Udn} (Fig. 6), therefore, those electrons measured by a magnetic polarizer (through magnetic transformation process) with magnetic field B_2 in T direction at polarization angle Θ , having a total quantum energy higher than E_{Udn} , should have the electron spin transformed from Up Mode to Down Mode. Also, those electrons after transformation having a total quantum energy lower than E_{Udn} should have the electron spin remain in Up Mode.

Thus, the Threshold Quantum Energy State $E_m(\Theta)$ can be calculated as follows:

$$E_m(\Theta) + \Delta E(\Theta) = E_{Udn}$$

$$E_m(\Theta) + K \sin^2(\Theta/2) = E_{Udn}$$

All Up Mode electrons having initial energy higher than the threshold energy $E_m(\Theta)$ will be transformed to Down Mode in T direction. Or on the other hand, those having initial energy lower than the threshold energy will remain in Up Mode in T direction.

Because at transformation angle $\Theta = 180^\circ$, all the electrons in S direction with electron spin in Up Mode will be transformed to Down Mode in T direction (Fig. 6). Therefore,

$$E_m(180^\circ) = 0.$$

And

$$E_m(180^\circ) + K \sin^2(90^\circ) = E_{Udn}$$

Therefore,

$$K = E_{Udn}$$

$$E_m(\Theta) = \cos^2(\Theta/2) E_{Udn}$$

$$\Delta E(\Theta) = \sin^2(\Theta/2) E_{Udn}$$

Where $E_m(\Theta)$ is threshold quantum energy state, $\Delta E(\Theta)$ is polarization energy and E_{Udn} is the highest spin-up quantum energy state of the initial electron in S polarization direction.

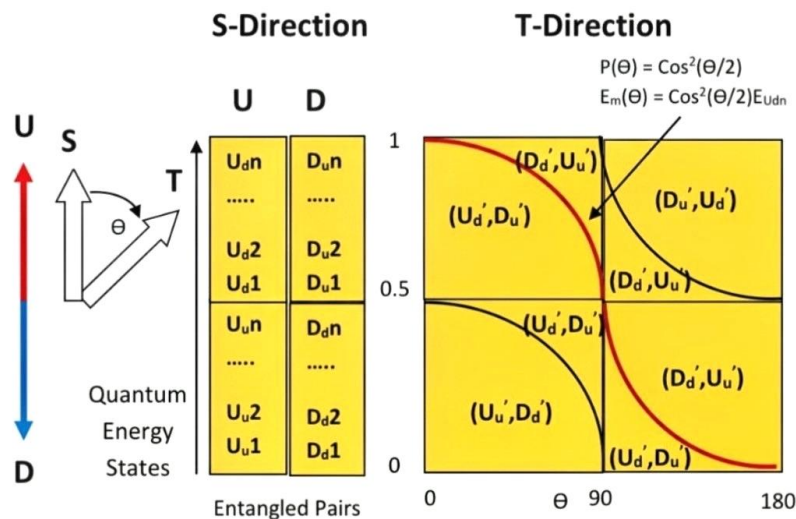


Fig. 6 Electron Polarization Transformation Diagram: The transformation Diagram of Entangled Electron pairs from S direction to T direction.

In addition, because all the electrons with quantum energy less than $E_m(\Theta)$ will remain in the Up Mode after transformation, therefore, the probability to find spin-up electrons in T direction can be calculated as follows:

$$P(\Theta) = E_m(\Theta)/E_{Udn} = \cos^2(\Theta/2) E_{Udn}/E_{Udn}$$

$$P(\Theta) = \cos^2(\Theta/2)$$

Fig. 6 (revised from [11][18]) shows a detailed diagram of electron polarization transformation from S direction to T direction at different polarization angles Θ . Where $\Delta E(\Theta) = \sin^2(\Theta/2) E_{Udn}$ is the polarization energy, E_{Udn} is the highest spin-up quantum energy state of the initial electron in S polarization direction, $E_m(\Theta) = \cos^2(\Theta/2) E_{Udn}$ is the threshold quantum energy state, and $P(\Theta) = \cos^2(\Theta/2)$ is the probability to find spin-up electrons in T direction. Fig. T is named “Electron Polarization Transformation Diagram” (revised from [11][18]).

D. Quantum Entanglement

A pair of electrons can be generated together with two quantum energy states (Hidden Variables) having the same quantum energy, but opposite spin modes (such as Up-Up versus Down-Down and Up-Down versus Down-Up). This is called Quantum Entanglement. When a pair of entangled electrons pass through an external magnetic field (magnetic polarization process), same polarization energies are added to the entangled electron pair. Subject to the threshold energy dependent on the polarization angle (polarization strength), the entangled electron pair can stay still entangled in the same spin modes or transform to the opposite spin modes (Up to Down and Down to Up). This is called “Field Dependent Entanglement” (revised from [13]). It is one of the major mysteries in quantum physics. Not only has it been misinterpreted by non-existing quantum superposition and free-will quantum entanglement but also it creates a big conflict with the limit of light speed and local realism. Based on Yangton and Yington Theory, quantum energy states are proposed as the Hidden Variables in electrons. Complying with the correlations between polarization energy, threshold energy and polarization angle (polarization strength), quantum entanglement can be very well explained.

XI. Photon Spin and Entanglement

A. Single Spin

According to Yangton and Yington Theory, photon is a free Wu’s Pair moving in space which contains a pair of Antimatter particles, Yangton and Yington circulating against each other on an orbit (revolution). It is also proposed that in addition to revolution, Yangton and Yington can both rotate by themselves (self-spin). However, because of the antimatter nature, their self-spins are always in opposite directions. This revolution dominated spin system is therefore named “Single Spin” (revised from [18][19]). In Single Spin, there are two major spin modes: “Up Spin” – revolution and Yangton self-spin in the same direction and “Down Spin” – revolution and Yangton self-spin in the opposite directions (Fig. 7 (revised from [18][19]).

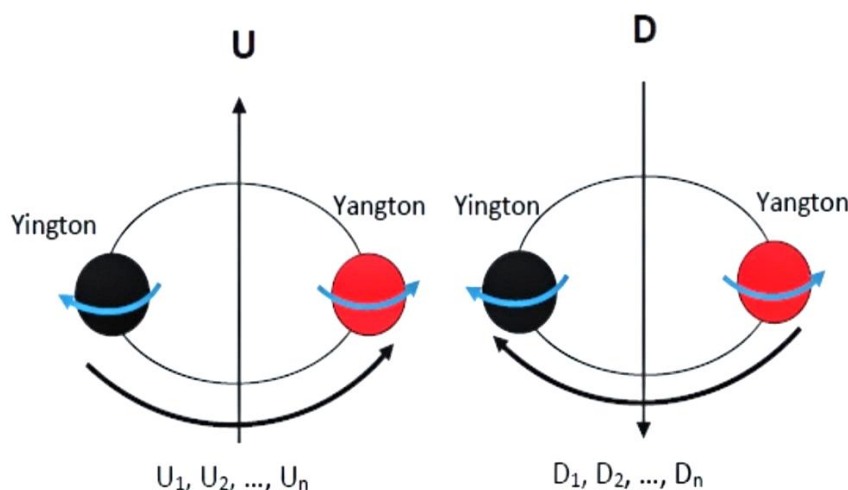


Fig. 7 Photon Spin contains two Modes: (1) Up Spin (2) Down Spin. Each mode contains equal amount of energy states.

B. Quantum Energy States

In a photon, the circulation of Yangton and Yington against each other on an orbit can generate a group of quantum energy states in different spin modes. Each quantum energy state can be represented by a composite code, for example U5 means the 5th energy level (such as the quantum energy of the photon that moves in a revolution loop with 5 standing waves) in Up Spin mode. According to Pauli Exclusion Principle, a photon can only occupy one quantum energy state in a spin mode at a time, therefore a pair of entangled photons should have the same quantum energy but opposite spin directions such as U5 and D5. In addition, all spin modes should have equal amount of quantum energy states. Also, all photons prefer to stay in a lower energy quantum energy state rather than the higher energy quantum energy state.

All the quantum energy states of a photon in various spin modes can be considered as the Hidden Variables of the photon. Since each photon produced from a coherent photon generator or an optical polarizer

(optical polarization process) occupies randomly a quantum energy state (Hidden Variable) in the coherent Up Spin mode at equal probability, therefore, the probability of those photons having quantum energies in a specific range of quantum energy states is equal to the ratio of the specific range over the total range of quantum energy states. This probability is also equal to the ratio of the photons found in the specific range over the total range of quantum energy states observed in experiments [13][19]. As a result, the consistency between the calculations and experiments has proven that Hidden Variables indeed exists, and Quantum Superposition Theory is false after all [13][17].

C. Optical Polarization Transformation

When coherent photons pass through an optical polarizer, their internal magnetic field is forced to follow the external magnetic field such that photons in the coherent Up spin mode can be converted to down-spin mode depending on the polarization strength (optical polarization angle) between the initial internal magnetic field and the external magnetic field.

Fig. 8 (revised from [18][19]) shows the mechanism of optical polarization in an infinitesimal time during optical polarization process, where B_1 is the initial internal magnetic field of the photon, B is the internal magnetic field, B_2 is the external magnetic field applied by an optical polarizer, and Θ is the angel between B and B_2 .

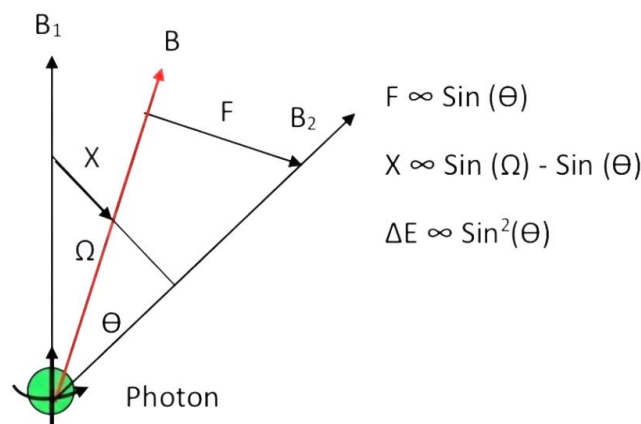


Fig. 8 Force and energy applied on a photon from an optical polarizer during optical polarization process.

As the internal magnetic field B of the photon moves from the initial internal magnetic field B_1 to the external magnetic field B_2 , a fixed amount of Optical Polarization Energy dependent on B_1 , B_2 and polarization angle (Ω), instead of subtraction, is added to the photon (revised from [18][19]). Consequently, subject to the total quantum energy in the photon, photon can stay either in the same Up spin mode or flip to the Down spin mode.

During the optical polarization process, when the internal magnetic field B of the photon moves to position X , where $X = k_1 B_1 (\sin \Omega - \sin \Theta)$ (revised from [18][19]) at angle Θ from the external magnetic field B_2 , an infinitesimal energy (dE) is added (revised from [18][19]) to the photon which can be calculated as follows:

$$dE = F dX$$

$$F = k_2 B_2 \sin \Theta$$

$$X = k_1 B_1 (\sin \Omega - \sin \Theta)$$

$$d \sin \Theta = \cos \Theta d\Theta$$

$$dX = -k_1 B_1 d \sin \Theta = -k_1 B_1 \cos \Theta d\Theta$$

$$dE = F dX = -k_1 B_1 k_2 B_2 \sin \Theta \cos \Theta d\Theta$$

Where B_1 is the initial magnetic field in the photon and B_2 is the external magnetic field applied on the photon, k_1 and k_2 are constants. Θ is the angle between the internal magnetic field B and the external magnetic field B_2 .

Therefore, with polarization angle Ω between B_1 and B_2 , the total magnetic polarization energy ΔE added to the photon as Θ changes from Ω to 0° , can be calculated as follows:

Because

$$\sin\Theta \cos\Theta d\Theta = 2d(\sin^2\Theta)$$

$$\Delta E = \int dE = \int -k_1 B_1 k_2 B_2 \sin\Theta \cos\Theta d\Theta = \int -2k_1 B_1 k_2 B_2 d(\sin^2\Theta)$$

$$K = 2 k_1 B_1 k_2 B_2$$

Therefore,

$$\Delta E = K (\sin^2(\Omega) - \sin^2(0^\circ))$$

Because

$$\sin^2(0^\circ) = 0$$

Therefore,

$$\Delta E(\Omega) = K \sin^2(\Omega)$$

Since the highest quantum energy state in the Up Mode of the photons with initial internal magnetic field B_1 in S direction is E_{Un} (Fig. 9), therefore, those photons passing through an optical polarizer (optical polarization transformation) with magnetic field B_2 in T direction at polarization angle Θ , having a total quantum energy after optical polarization transformation higher than E_{Un} , should have the optical spin transformed from Up Mode to Down Mode. Meanwhile, those photons after optical polarization transformation having a total quantum energy lower than E_{Un} should have the photon spin remain in Up Mode.

Thus, the Threshold Quantum Energy State $E_m(\Theta)$ can be calculated as follows:

$$E_m(\Theta) + \Delta E(\Theta) = E_{Un}$$

$$E_m(\Theta) + K \sin^2(\Theta) = E_{Un}$$

All Up Mode photons having initial energy higher than the threshold energy $E_m(\Theta)$ will be transformed into Down Mode in T direction. Or on the other hand, those having initial energy lower than the threshold energy will remain in Up Mode in T direction (revised from [18][19]).

Because of the plane symmetry in optical polarizers, at transformation angle $\Theta = 90^\circ$, all the photons in S direction with photon spin in Up Mode will be transformed to Down Mode in T direction (Fig. 9). Therefore,

$$E_m(90^\circ) = 0$$

And

$$E_m(90^\circ) + K \sin^2(90^\circ) = E_{Un}$$

Therefore,

$$K = E_{Un}$$

And

$$\Delta E(\Theta) = \sin^2(\Theta) E_{Un}$$

$$E_m(\Theta) = \cos^2(\Theta) E_{Un}$$

Where $E_m(\Theta)$ is threshold quantum energy state, $\Delta E(\Theta)$ is polarization energy and E_{Un} is the highest spin-up quantum energy state of the initial photon in S polarization direction.

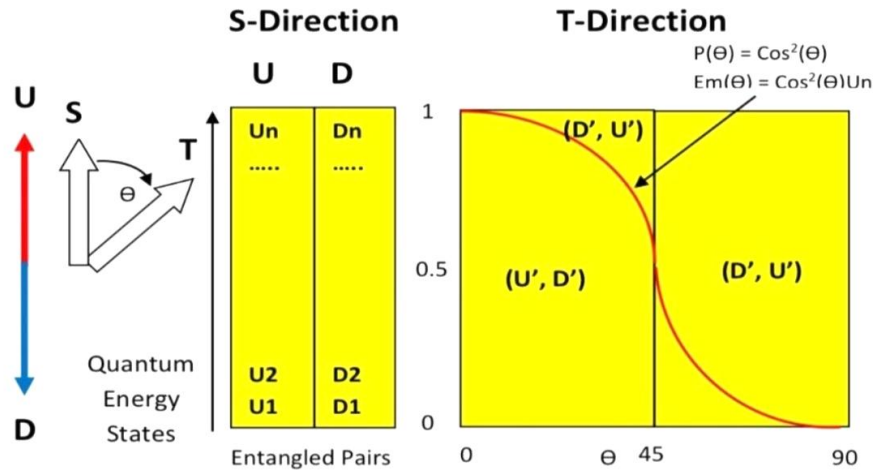


Fig. 9 Photon Polarization Transformation Diagram: The Transformation Diagram of Entangled Photon pairs from S direction to T direction.

In addition, because all the photons with quantum energy less than $E_m(\Theta)$ will remain in the Up Mode after transformation, therefore, the probability to find spin-up photons in T direction can be calculated as follows:

$$P(\Theta) = E_m(\Theta)/E_{Un} = \cos^2(\Theta)E_{Un}/E_{Un}$$

$$P(\Theta) = \cos^2(\Theta)$$

Fig. 9 (revised from [18][19]) shows a detailed diagram of photon polarization transformation from S direction to T direction at different polarization angles Θ . Where $\Delta E(\Theta) = \sin^2(\Theta) E_{Un}$ is the polarization energy, E_{Un} is the highest spin-up quantum energy state of the initial photon in S polarization direction, $E_m(\Theta) = \cos^2(\Theta) E_{Un}$ is the threshold quantum energy state, and $P(\Theta) = \cos^2(\Theta)$ is the probability to find spin-up photons in T direction. Fig. W is named “Photon Polarization Transformation Diagram” (revised from [18][19]).

D. Photon Entanglement

Like electrons, a pair of photons can also be generated together with two quantum energy states (Hidden Variables) having the same quantum energy, but opposite spin modes (Up Spin versus Down Spin). This is called Photon Entanglement. When a pair of entangled photons pass through an optical polarizer, same polarization energies are added to the entangled photon pair. Subject to the threshold energy dependent on the polarization angle (polarization strength), the entangled photon pair can stay still entangled in the same spin modes or transform to the opposite spin modes (Up to Down and Down to Up). This is called “Field Dependent Entanglement” (revised from [13]). Again, it implies that both superposition and free-will photon entanglement do not exist.

XII. Conflicts in Quantum Mechanics

According to Yangton and Yington Theory, both wave and particle properties can coexist in a spinning polarized particle such as photons and electrons. In Double Slit Interference experiment, particle detectors are used to influence the phase angles of particle waves such that coherency is disturbed and interference patterns are diminished. However, the interruption of the interference patterns cannot be used to prove the non-existence of wave property, or that wave and particle properties cannot coexist under simultaneous observation. Therefore, “Complementarity Principle” is not true.

Furthermore, according to Yangton and Yington Theory, under both thermal equilibrium at constant temperature and pressure, and subatomic equilibrium at constant gravitational field and aging of the universe, each photon and electron has its own quantum energy state which is named “Hidden Variables”. Through polarization process, subject to the polarization angle (polarization strength), a corresponding polarization energy can be added to each photon and electron. Also, a corresponding threshold energy can be obtained in the polarization process. For those photons and electrons which have initial quantum energies higher than the threshold energy, they can gain polarization energy through polarization process and overcome the highest quantum energy state in the spin-up mode, so as to enter the spin-down mode in the new polarization direction (revised from [11][19]). Or on the other hand, for those photons and electrons which have initial quantum energies lower than the threshold energy, they will remain at the same spin-up mode in the new polarization direction. After polarization process, photons and electrons remaining in spin-up quantum energy states can be normalized with even distribution to the entire quantum energy states in the new polarization direction [12]. These quantum energy states generated from magnetic and optical polarization processes are named “Field Dependent Hidden Variables”.

Bell’s Inequality is based on Set Theory and can only be applied to the same sample space. Therefore, in photon multiple polarization experiments, Bell’s Inequality applying on the mixed sample spaces cannot be used to prove if Hidden Variables exist or not. On the other hand, in electron entanglement experiments, because the experiment data applied for the analyses lacks probability of polarization transformation, also the experiments have many loopholes themselves, therefore the proof of non-existence of Hidden Variables by those experiments based on Bell’s Inequality are all invalid. In fact, probability of polarization transformation for each electron or photon is equal to the ratio of the transformed electrons or photons remaining in the Spin Up mode to the total electrons or photons in the polarization transformation process. This was proved by experiments which confirm that quantum energy states are indeed the Hidden Variables.

A pair of electrons (photons) can be generated together with two quantum energy states (Hidden Variables) having the same quantum energy, but opposite spin modes (such as Up-Up versus Down-Down and Up-Down versus Down-Up). This is called “Quantum Entanglement”. When a pair of entangled electrons (photons) pass through an external magnetic field (magnetic polarizer or optical polarizer), same polarization energies are added to the entangled electron (photon) pair. Subject to the threshold energy dependent on the polarization angle (polarization strength), the entangled electron (photon) pair can stay still entangled in the same spin modes or transform to the opposite spin modes (Up to Down and Down to Up). This is called “Field Dependent Entanglement” (revised from [13]).

For more than a century, Quantum Entanglement has been kept one of the major mysteries in modern physics. Not only has it been misinterpreted by non-existing quantum superposition and free-will quantum entanglement but also it creates a big conflict with the limit of speed and local realism. Even though Quantum Mechanics has been misinterpreted by scientists in the past decades. Also, a serious challenge has been raised against Superposition and Complementarity, the heart of Quantum Mechanics, still Quantum Mechanics is a very well-established scientific theory based on the probability and statistic natures of the quantum energy states in spinning polarized particles such as electrons and photons.

XIII. Conclusion

According to the new models of electron and photon polarization processes based on Yangton and Yington Theory, quantum energy states of the electrons and photons in each spin mode are considered as the Hidden Variables of the electrons and photons. Polarization energies dependent on the polarization angles are added to each electron and photon through polarization processes. Subject to the polarization energy and threshold energy dependent on the polarization angle, electrons and photons can stay either at the same spin mode or transform to the opposite spin mode through the polarization process. These field dependent quantum energy states generated through polarization processes are called Field Dependent Hidden Variables. The probability of polarization transformation is calculated as a function of polarization angle which matches with the ratio of polarization transformation measured in experiments.

Furthermore, according to Quantum Entanglement, a pair of electrons (photons) can be generated together with two entangled quantum energy states (Hidden Variables) having the same quantum energy but of the opposite spin modes. When a pair of entangled electrons (photons) passing through a magnetic (optical) polarizer, the polarization angle and polarization energy are the same for both electrons (photons). However, subject to the polarization energy and threshold energy dependent on the polarization angle, the electron (photon)

pair can stay still entangled in either the same spin modes or transform to the opposite spin modes. This is called Field Dependent Entanglement.

For more than a century, quantum entanglement was kept one of the biggest mysteries in modern physics. Not only has it been misinterpreted by non-existing quantum superposition and free-will quantum entanglement, but also it creates a big conflict with the limit of speed and local realism. Based on Yangton and Yington Theory, quantum energy states are proposed as the Hidden Variables of electrons and photons. The correlations between polarization energy, threshold energy and polarization angle are carefully studied, and quantum entanglement is successfully explained. As a result, superposition and free-will entanglement are not true. Instead, Hidden Variables do exist, and Bell's Inequality is always obeyed.

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