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# Quantum Entanglement and Hidden Variables Interpreted by Yangton and Yingtom Theory

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*[**Abstract]:** A model of quantum entanglement of electrons is proposed and studied based on Yangton and Yington Theory. Dual Spins and Quantum Entanglement Phase Diagram are developed to explain the transformation between Four Spin Modes during the measurements. "Hidden Variables" (original entanglement quantum states) does exist but can be influenced by the measurements. This result breaks Bell's inequality and supports Einstein's argument in EPR paradox. Quantum Theory maybe is indeed incomplete.*
***[Keywords]:*** *Yangton and Yington, Wu's Pairs, Photon, String Theory, Electron, Quantum Entanglement, Quantum Mechanics, Electron Spin, Dual Spins, Spin Modes, Hidden Variables, EPR Paradox, Bell's Inequality.*

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## I. Introduction

1. Yangton and Yington Theory

Yangton and Yington Theory [1] is a hypothetical theory of Yangton and Yington circulating particle pairs (Wu's Pairs) [1] with a build-in inter attractive force (Force of Creation) [1] that is proposed as the fundamental building blocks of all matter in the universe. All elementary subatomic particles [2] having string structures as proposed by the String Theory [4], are made of Wu's pairs by string force [3], the Yangton and Yington attractive force between two adjacent Wu's Pairs. Subject to the structures, the composite subatomic particles [2] are made of elementary subatomic particles by four basic forces including gravitational force, electromagnetic force, weak force and strong force. Yangton and Yington Theory can explain the formation of subatomic particles [3] in accordance to String Theory and Unified Field Theory [5], and also interpret the correlations between space, time, energy and matter [6].

2. Wu's Pair – The Building Block of the Universe

According to the 4th Principle, with the external energy generated from Big Bang explosion, a Yangton and Yington circulating pair with an inter-attractive Force of Creation named "Wu's Pair" (Fig. 1) can be formed so that Something can become a permanent matter. These Wu's Pairs are the fundamental building blocks (God's Particles) of all matter such as photons, quarks, electrons, positrons, neutrons, protons, etc.

From Something to a permanent Wu's Pair, the reaction process can be represented by the following formulas:

$$\text{Yangton } \Theta \text{ Yington} \rightarrow \text{Yangton } \Phi \text{ Yington} \quad \Delta E = \text{ECirculation}$$

$$\text{ECreation} + \text{ECirculation} \leftrightarrow \text{Yangton } \Phi \text{ Yington}$$

Where "Yangton Θ Yington" represents Something – a temporary Yangton and Yington pair. "Yangton Φ Yington" represents Wu's Pair – a permanent Yangton and Yington circulating pair. ECreation is Energy of Creation which is used to generate Force of Creation. ECirculation is the circulation energy which includes both potential and kinetic energies of the circulation. The summation of ECreation and ECirculation is called "Wu's Pair Formation Energy" which can be generated either from Big Bang explosion [7].

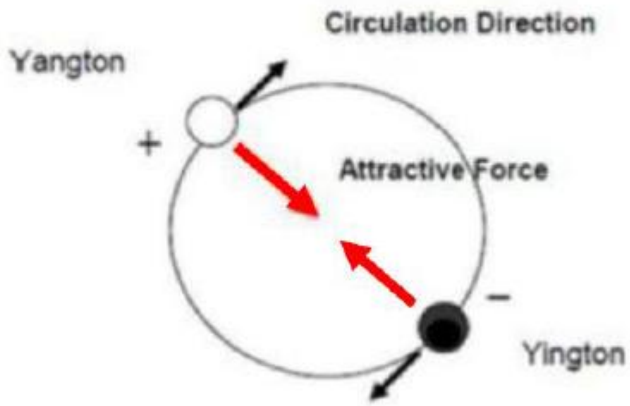


Fig. 1 Wu's Pair - a Yangton and Yington circulating pair.

3. Photon – A Free Wu's Pair

When Wu's Pair is released from a substance, it becomes a free particle known as "Photon". Photon travels in space at a constant Absolute Light Speed 3x108 m/s [8] while observed at the light source. The reaction process can be represented as follows:

$$\text{Yangton } \Phi \text{ Yington} \rightarrow \text{Photon} \qquad \Delta E = h\nu$$

Where "Yangton Φ Yington" is Wu's Pair and hν is photon's kinetic energy.

4. String Theory

General Relativity [9] and Quantum Field Theory [10] are not compatible, in order to unified four basic forces, physicists suggested that all matter, instead of a point structure, must have a linear structure with 10 dimensions like Calabi-Yau manifold (Fig. 2). This is known as the "String Theory" [4].

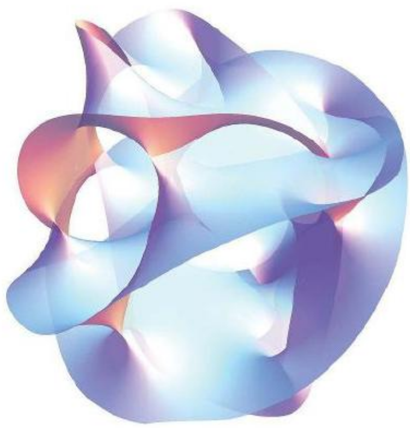

Fig. 2 A cross section of a quintic Calabi-Yau manifold.

Physicists have absolutely no idea what the structures of quarks and photon are, even with their state-of-the-art LHC [11]. However, based on the Yangton and Yington Theory, that all subatomic particles should have a string structure is not only very possible, but also quite obvious.

Wu's Pair is a pair of Yangton and Yington particles circulating in an orbit held by the inter-attractive Force of Creation between the two particles. When two Wu's Pairs come together with the same circulation direction, there is an interaction, which I call "String Force" [3], that one Wu's Pair will stack up on top of the other one at a locked-in position where Yangton of the first Wu's Pair is lined up to the Yington of the second one, such that a string or ring structure of Wu's Pairs can be formed (Fig. 3), which matches very well with the String Theory.

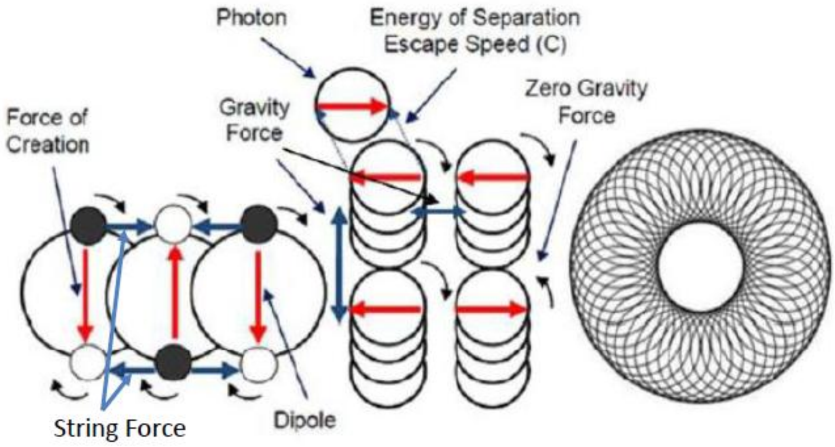


Fig. 3 Wu's Pairs stack up in a preferred direction by string force to form string and ring structures.

5. Electron, Positron and Electrical Force

When a number of Wu's Pairs come together they can stack up to form a string or ring structures, or cross each other's orbits to form a structure that is either with Yingtons circulating the Yangton center as the electrons (Fig. 4) [3] or with Yangtons circulating the Yington center as the positrons (Fig. 4) [3].

Since photon, a free Wu's Pair, can be absorbed and emitted from an electron jumping between two energy levels in an atom; it is proposed that electron is composed of a group of Wu's Pairs, where Yangtons are loosely confined in the center due to the compression of the centrifugal force caused by the circulation of Yingtons. Similarly, positron is composed of a group of Wu's Pairs, where Yingtons are loosely confined in the center due to the compression of the centrifugal force caused by the circulation of Yangtons. Therefore, electron can have an appearance looks like a sphere of Yingtons, and positron, on the other hand, can have the appearance looks like a sphere of Yangtons (Fig. 4) [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 as well as between two positrons. 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" [12].

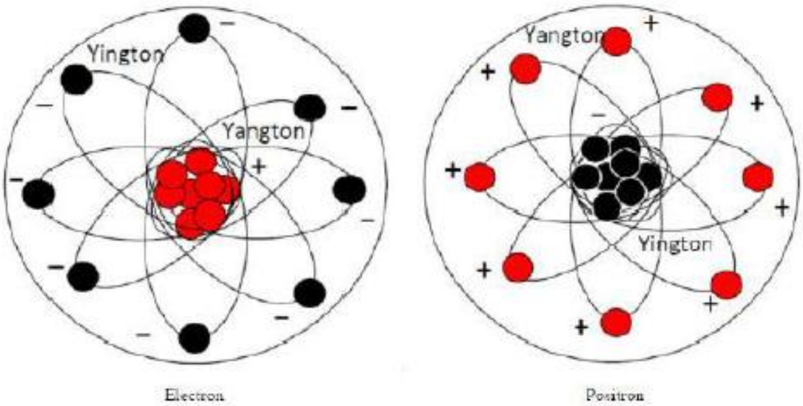


Fig. 4 Hypothetical structures of electrons and positrons.

## II. Quantum Entanglement

Quantum entanglement 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 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 first axis, then the spin of the other particle, measured on the same axis, even instantly will be found to be counterclockwise. However, this behavior gives rise to paradoxical effects: any measurement of a property of an entangled particle results in an irreversible wave function collapse of that particle which can cause interruption of the entanglement and subsequently a random state of the other particle can be measured.

In 1935, Albert Einstein, Boris Podolsky, and Nathan Rosen [13] brought up EPR paradox, in which Einstein and others considered such behavior 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. 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 predictions of quantum theory.

## III. Paradox

The paradox is stated as follows: 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.

## IV. Hidden Variables

Despite the impossible solution that the communication between two particles can be so fast even more than light speed, a possible resolution to the paradox is to assume that quantum theory is incomplete, and the result of measurements depends on predetermined "hidden variables" [14]. 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. 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.

The hidden variables theory fails, however, when measurements of the spin of entangled particles along different axes. If a large number of pairs of such measurements are made (on a large number of pairs of entangled particles), then statistically, if the hidden variables view were correct, the results would always satisfy Bell's inequality [15]. Since a number of experiments have shown in practice that Bell's inequality is not satisfied, therefore hidden variables cannot be true. However, I wonder if those hidden variables did exist but were influenced by the measurement, such that the statistical results moved away from Bell's inequality.

## V. Quantum Entanglement Interpreted by Yangton and Yington Theory

1. Dual Spins

According to Yangton and Yington Theory, electron has a ball structure (Fig. 4) which is composed of an outer shell (a group of circulating Yingtons) and an inner core (a cluster of rotating Yangtons). It is proposed when electron spins, they can move either in the same directions or the opposite directions. This phenomenon is named "Dual Spins". In Dual Spin System, there are two major categories: "Up Spin" and "Down Spin" which are defined by the circulation direction of Yington Shell. In addition, there are two minor categories: "Forward Spin" and "Backward Spin" which are defined by both directions of Yington Shell and Yangton core. Together, there are a total of four spin modes: Up-Up ($U_u$) and Up-Down ($U_d$) modes for Up Spin; and Down-Down ($D_d$) and Down-Up ($D_u$) modes for Down Spin (Fig. 5).

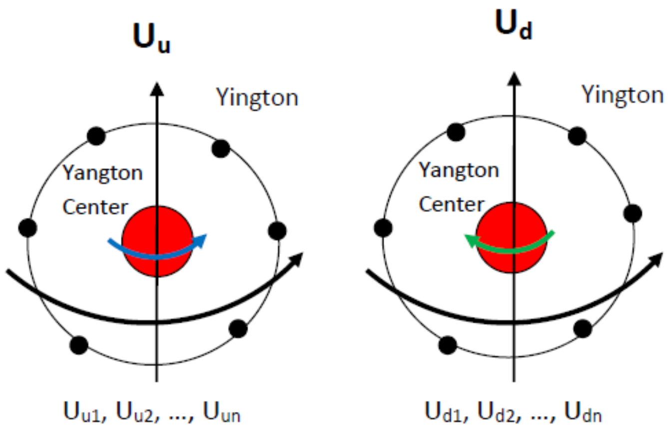


Fig. 5 Electron Spin contains Four Modes: (1) Up Spin: UP-UP ($U_u$) and UP-Down ($U_d$) modes, (2) Down Spin: Down-Down ($D_d$) and Dow-Up ($D_u$) modes. Each mode contains equal amount of energy states.

2. Quantum States

Subject to the difference of the angular momentums between Yington Shell and Yangton Core, there are a number of quantum states in each of the spin modes. Each quantum state can be represented by a composite code, for example $U_u5$ means the 5th energy level of Up-Up ($U_u$) Mode. According to Pauli Exclusion Principle [16], an electron can only occupy one quantum state at a time, therefore a pair of entangled electrons should have quantum states of the same energy but opposite spin modes such as $U_u5$ and $D_d5$. In addition, all spin modes have equal amounts of quantum states. Furthermore, it is proposed that backward spin $U_d$ has higher energy than that of forward spin $U_u$ (same for $D_u$ and $D_d$). Also, all electrons prefer to stay in the low energy quantum states rather than the high energy quantum states.

3. Entangled Electrons

According to Yangton and Yington Theory, a pair of entangled electrons means two correlated electrons that each has a corresponding quantum state of the same energy but opposite spin modes. For example: ($U_u5$, $D_d5$) and ($U_d3$, $D_u3$).

4. Transformation

To measure the electron spin, a magnetic field is applied to the electron in a specific direction and the electron is detected in either spin up or spin down directions. Fig 6 shows a electron spin measurement, where $B_1$ is the internal magnetic field of the electron, $B_2$ is the external magnetic field applied by the measurement device and Ɵ is the angel between $B_1$ and $B_2$.

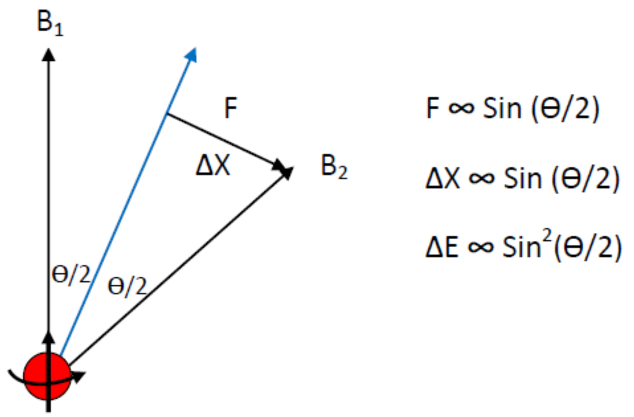


Fig. 6 Force and energy applied on an electron spin at measurement.

Because

$F \propto \sin(\Theta/2)$

$\Delta X \propto \sin(\Theta/2)$

$\Delta E \propto \sin^2(\Theta/2)$

In Up-Down mode, the highest energy quantum state is $E_{Ud}n$ (Fig. 7). Any quantum state has higher energy than $E_{Ud}n$ will be transformed to Down-Up mode in the new direction, therefore,

$$E(\Theta) + \Delta E(\Theta) \geq E_{Ud}n$$

$$E(\Theta) + K \sin^2(\Theta/2) = E_{Ud}n$$

Where $E(\Theta)$ is the minimum energy quantum state to be transformed and $\Delta E(\Theta)$ is the transformation energy at angle $\Theta$.

Because at $\Theta = 90^o$, all quantum states in Up-Down mode will be transformed to the Down-Up Mode in the new direction (Fig. 7), therefore,

$$E(\Theta) = \frac{1}{2} E_{Ud}n$$

$$\frac{1}{2} E_{Ud}n + \frac{1}{2} K = E_{Ud}n$$

$$K = E_{Ud}n$$

Because

$$E(\Theta)/ E_{Ud}n + (K/E_{Ud}n) \sin^2(\Theta/2) = E_{Ud}n/ E_{Ud}n$$

Therefore,

$$E(\Theta)/ E_{Ud}n = \cos^2(\Theta/2)$$

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

Because all quantum states below $\cos^2(\Theta/2)$ will remain in the same modes after transformation, therefore, the overall possibility to find the spin up mode in the new direction is $P(\Theta) = \cos^2(\Theta/2)$ (Fig. 7).

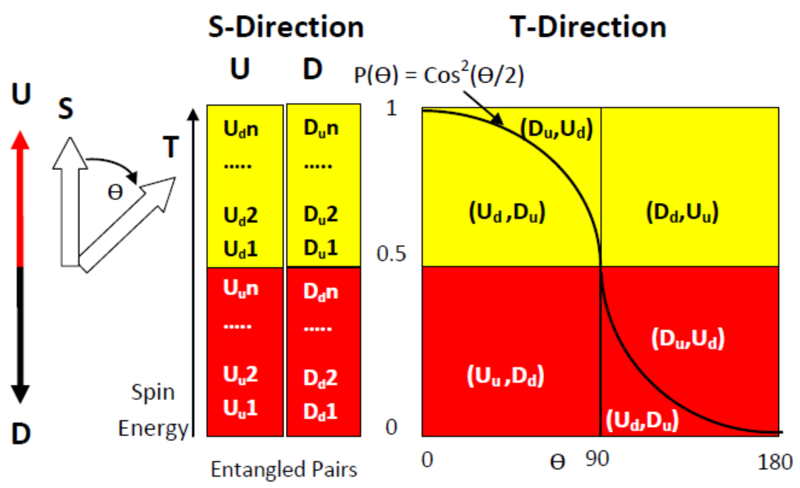


Fig. 7 Quantum Entanglement Phase Diagram: The transformation Diagram of Entangled Electron pairs from S direction to T direction.

Fig. 7 shows a detailed diagram of the transformation, in which entangled electron pairs ($U_n$n, $D_d$n) and ($U_d$n, $D_u$n) in S direction are transformed to T direction in different entangled modes at an angel from $0^o$ to $180^o$. This diagram is named "Quantum Entanglement Phase Diagram".

A detailed mathematical derivation of this phase diagram can be shown as follows:

A. Up-Down Mode ($U_d$)

1. $\Theta < 90^o$

a. $E_{Ud} + \Delta E(\Theta) < E_{Ud}n$

$E_{Ud} + (1 - COS^2(\Theta/2)) < E_{Ud}n$

$E_{Ud} < COS^2(\Theta/2)$

Therefore $U_d \rightarrow U_d$

b. $E_{Ud} + \Delta E(\Theta) \geq E_{Ud}n$

$E_{Ud} + (1 - COS^2(\Theta/2)) \geq E_{Ud}n$

$E_{Ud} \geq COS^2(\Theta/2)$

Therefore $U_d \rightarrow D_u$

2. $\Theta \geq 90^o$

a. $E_{Ud} + \Delta E(\Theta) \geq E_{Ud}n$

$E_{Ud} + (1 - COS^2(\Theta/2)) \geq E_{Ud}n$

$E_{Ud} \geq COS^2(\Theta/2)$

Therefore, $U_d \rightarrow D_d$

B. Up-Up Mode ($U_u$)

1. $\Theta < 90^o$

a. $E_{Uu} + \Delta E(\Theta) < E_{Ud}n$

$E_{Uu} +(1 - COS^2(\Theta/2)) < E_{Ud}n$

$E_{Uu} < COS^2(\Theta/2)$

Therefore, $U_u \rightarrow U_u$

2. $\Theta \geq 90^o$

a. $E_{Uu} + \Delta E(\Theta) < E_{Ud}n$

$E_{Uu} +(1 - COS^2(\Theta/2)) < E_{Ud}n$

$E_{Uu} + (1- E_{Ud}n) < COS^2(\Theta/2)$

$E_{Uu} < COS^2(\Theta/2)$

Therefore, $U_u \rightarrow U_d$

b. $E_{Uu} + \Delta E(\Theta) \geq E_{Ud}n$

$E_{Uu} +(1 - COS^2(\Theta/2)) \geq E_{Ud}n$

$E_{Uu} + (1- E_{Ud}n) \geq COS^2(\Theta/2)$

$E_{Uu} \geq COS^2(\Theta/2)$

Therefore, $U_u \rightarrow D_u$

A corresponding identical result can also be derived for Down-Up Mode ($D_u$) and Down-Down Mode ($D_d$) (Fig. 7).For all possible transformations (Fig. 7), the entangled electrons in S direction can be transformed to T direction either remain the same mode or change to a new double-flip mode (UP → Down and Down → Up). In other words, the "Hidden Variables" (predetermined entangled quantum states) can be changed to a new entanglement state under the influence of measurement. As a consequence, this result breaks Bell's inequality and supports Einstein's argument in his famous EPR paradox. Furthermore, measurements can also influence the phase angles of particle waves in Double Slits Interference experiment [17]. Both of these results raised a serious challenge to the heart of Quantum Theory. After all, Einstein's instinct maybe was correct all along, even though most of his interpretations were wrong [18], and Quantum Theory is indeed incomplete.

## VI. Conclusion

A model of quantum entanglement of electrons is proposed and studied based on Yangton and Yington Theory. Dual Spins and Quantum Entanglement Phase Diagram are developed to explain the transformation between Four Spin Modes during the measurements. "Hidden Variables" (original entanglement quantum states) does exist but can be influenced by the measurements. This result breaks Bell's inequality and supports Einstein's argument in EPR paradox. Quantum Theory maybe is indeed incomplete.

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