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Hidden Variables Do Exist and Bell's Inequality Does Obeyed

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[Abstract]
According to Yangton and Yington Theory, all photons and electrons have predetermined quantum energy states (Hidden Variables). During photon polarization and electron magnetic polarization processes, their quantum states (Hidden Variables) can be changed either by adding energy to electron or reducing energy from photon to become a new quantum states (Field Dependent Hidden Variables). For further transformation (polarization processes), according to Principle of Normalization, a normalized quantum energy states can be achieved (Normalized Field Dependent Hidden Variables). Since Bell Inequality based on Set Theory can only be applied on the same sample space, therefore, for polarization experiments applying on the mixed sample spaces (Hidden Variables and Field Dependent Hidden Variables), Bell's Inequality cannot be used to prove if Hidden Variables exist or not. On the other hand, for Quantum Entanglement experiments applying on the same sample space of Hidden Variables, Bell's Inequality can be used to prove the existence of the Hidden Variables (A detailed analysis is studied in this paper). Furthermore, since both entangled photons (and entangled electrons) have the same Hidden Variables except in opposite spin directions. Under the same polarization processes (measurements), they both gain or lose the same energies and pass through the same threshold energy barriers to get to the same Field Dependent Hidden Variables in opposite directions. Therefore, they are always entangled no matter how far the distance and how fast the time are. The existence of Hidden Variables fulfills Bell's Inequality which raises a big challenge to Quantum Superposition and Quantum Entanglement.
[Keywords]
Quantum Entanglement, Superposition, EPR Paradox, Bell's Inequality, Hidden Variables, Electron Spin, Photon Spin, Optical Polarization, Magnetic Polarization, Schrödinger Cat.

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I. Quantum Superposition

Quantum Superposition is a fundamental principle of quantum mechanics. Any two (or more) quantum states can be added together ("superposed") and the result will be another valid quantum state; and conversely, that every quantum 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 states, spin up and spin down, in Schrödinger equation.

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 fixed 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: (1) The speed of communication could be faster than speed of light (assuming light speed is the limit of speed), (2) 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.

III. EPR Paradox

In 1935, Albert Einstein, Boris Podolsky, and Nathan Rosen [1] 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.

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.

IV. Hidden Variables

Despite the impossible solution that the 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" [2]. 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 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 a large number of pairs of entangled particles, statistically, if the hidden variables view were correct, then the results would always satisfy Bell's Inequality [3]. Since a number of experiments have shown in practice that Bell's Inequality is not satisfied, therefore it is believed that hidden variables are not true and quantum mechanics is surely based on Superposition and Complementarity.

V. Bell's Inequality

Bell's Inequality is a mathematical theory based on Set Theory (Fig. 1) [4]. Bell's Inequality is true only if all the elements are in the same sample space and have predetermined variables. In case of photon polarization, when a light beam passing through three polarizers with polarization angles A = 0^o, B = 22.5^o and C = 45^o, the intensity of the transmitted light can be shown in Table 1 [4]. Where "Real Transmission" is the actual measurement results and "Bell Transmission" is the theoretical results based on Bell's Inequality. Because the actual measurement results of Real Transmission are different from that of Bell Transmission, therefore, It is claimed that Hidden Variables doesn't exist and it cannot be the solution of EPR Paradox. In other words, quantum theories such as Superposition Theory and Complemantarity Principle must be true.

Bell's Inequality sounds great, but a necessary (must) condition of Bell's Inequality is missing, that is "In Set Theory, which is the basis of Bell's Inequality, all elements in the sample space must stay unchanged (keeping the same sample space) no matter the distribution and future transformation of the elements". In polarization experiments, energy is first added to electrons or reduced from photons during the polarization processes, then further normalized in the subsequent polarization processes. In other words, the elements (photons and electrons) used in the calculation of Bell's Inequality are taken from mixed sample spaces instead from the same sample space. Therefore, all efforts in polarization experiments using simulated Bell's Inequality to prove that Hidden Variables doesn't exist are in vain. As to the quantum entanglement experiments, because all the elements are taken from the same sample space, Bell's Inequality should be hold and the existence of Hidden Variables can be proven. But, in reality, because of the inaccurate analysis, a number of false results were reported which have caused a lot of misunderstandings and confusions.

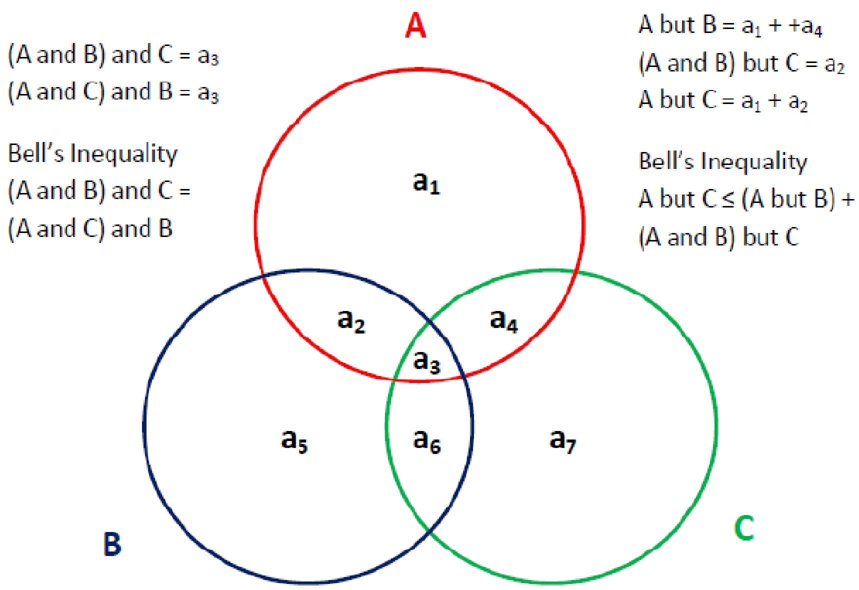

Fig. 1 Bell's Inequality Diagram – The distribution of elements in three domains (sets). All elements must stay unchanged no matter of distribution.

VI. Field Dependent Hidden Variables

According to the models of photon and electron based on Yangton and Yington Theory, all photons and electrons should have their predetermined quantum energy states (Hidden Variables) [5] [6]. Through polarization process either by optical polarize lens for photon or magnetic field for electron, subject to the polarization strength based on the polarization angle, an energy barrier (for photon) [5] or a threshold energy (for electron) [6] are established.

In case of optical polarization, for those photons which have higher energy than the energy barrier (established by the polarization angle) will pass through the polarizer and keep the same polarization direction as the polarizer, or otherwise, they will be blocked by the polarizer.

In case of magnetic polarization, for those electrons which have initial energy higher than the threshold energy (established by the polarization angle) will gain the polarization energy (provided by magnetic field) to overcome the energy barrier and flip of to the opposite spin direction, or otherwise, they will maintain the original spin status in the new polarization direction.

The original quantum energy states (Hidden Variables) generated by polarizer A forms the "Same Sample Space" (Hidden Variables Sample Space) for the next polarization processes (such as those carried out by polarizer B or polarizer C). After the next polarization process, the new quantum energy states is is generated which is called "Field Dependent Hidden Variables" [7] forms the "Same Sample Space" (Field Dependent Hidden Variables Sample Space) for further normalization polarization processes.

Field Dependent Hidden Variables" are determined by the original quantum energy states (Hidden Variables) and polarization field (polarization angles). Because all photons (and electrons) in different quantum energy states have equal opportunity to be emitted from the light (electron) sources, the probability to find the photons either pass through or block out by the polarizer , or the electrons either spin up or spin down by the magnetic polarizer, is also dependent on the polarization fields (polarization angles) of the polarization processes (measurements).

VII. Principle of Normalization

In optical polarization (for photon) and magnetic polarization (for electron) processes, before transformations, both photons and electrons have their fixed quantum energy states (Hidden Variables). After transformations by adding energy to electrons and reducing energy to photons, they are regenerated with Field Dependent Hidden Variables (the new quantum energy states in the new polarization directions). For subsequent transformations, both photons and electrons repeat the same distribution patterns while under the same polarization strength (angle) as the previous transformations. This phenomenon is named "Principle of Normalization" [7].

For example, as shown in Table 1, the real transformation always obeys Principle of Normalization. The ratio of photons passing through B polarizer (22.5^o from A polarizer) noted as "A and B" is 85%, and the ratio of these photons passing through another C polarizer (22.5^o from B polarizer and 45^o from A polarizer) noted as "(A and B) and C" is 72.25% (because 85% x 85% = 72.25%). It is bigger than the ratio of photons passing only through C polarizer noted as "A and C" which is 50%. It is also different from the ratio of photons passing through C polarizer then B polarizer noted as "(A and C) and B" which based on Principle of Normalization is 42.5% (because 50% x 85% = 42.5%).

Table 1 The Real Transmission and Bell Transmission of three polarizers with polarization angels A = 0^o, B = 22.5^o, C = 45^o.

Polarizer	Real Transmission	Bell Transmission
A	100%	100%
A and B	85%	75%
A but B	15%	25%
(A and B) and C	72.25%	50%
(A and B) but C	12.75%	25%
(A but B) + ((A and B) but C)	27.75%	50%
A and C	50%	50%
A but C	50%	50%
(A and C) and B	42.5%	50%
Bell's Inequality (A but C) ≤ (A but B) + ((A and B) but C)	50% > 27.75%	50% ≤ 50%
Bell's Inequality (A and B) and C = (A and C) and B	72.25% ≠ 42.5%	50% = 50%
Remarks	Doesn't meet Bell's Inequality	Meets Bell's Inequality

VIII. Bell's Inequality Experiments

How to prove the existence of Hidden Variables is a big challenge. The models of photon and electron based on Yangton and Yington Theory are only assumptions. They are too small to be directly observed and measured. However, based on Set Theory, in the same sample space, all photons and electrons with Hidden Variables such as quantum energy states can be used to form Sets, and all Sets should obey Bell's Inequalities. Therefore, if any Set of photons and electrons that doesn't satisfy Bell's Inequality, then it is proven that photon and electron don't have Hidden Variables. Because of this reason, a variety of experiments were carried out by different groups of scientists, trying to prove that there is no predetermined variables (Hidden Variables) in photon and electron, such that Quantum Superposition is correct and Einstein's EPR Paradox is wrong. Those experiments can be classified into two categories: polarization experiments and quantum entanglement experiments.

IX. Polarization Experiments (Mixed Sample Spaces)

In both photon polarization and electron magnetic polarization experiments, all photons and electrons emitted from the coherent source are polarized with their quantum energy states (Hidden Variables) in the polarization direction. During the polarization processes, they can be transformed to a new field dependent quantum energy states (Field Dependent Hidden Variables) in the new polarization directions either by adding energy to electrons or reducing energy from photons. A subsequent polarization process based on Principle of Normalization can convert further Field Dependent Hidden Variables to Normalized Field Dependent Hidden Variables (normalized quantum energy states). In other words, all elements (photons and electrons with their quantum energy states) after transformation are in a new sample space, which are no longer the same elements and sample space before transformation. Because all the elements (photons and electrons) in real transformation (Table 1) are taken from mixed sample spaces in calculation of simulated Bell's Inequality. Since Bell's Inequality is based on Set Theory which can only apply to the same sample space, therefore, simulated Bell's Inequality obtained from mixed sample spaces cannot be used to prove if Hidden Variables exist or not.

For example, in Table 1, "(A and B) and C" and "(A and C) and B" are in different Field Dependent Hidden Variables spaces transformed from the same sample space containing Hidden Variables "A and B" and "A and C". Since Bell's Inequality is based on Set Theory which can only be applied on the same sample space. In other words, all elements used in Bell's Inequality must come from the same sample space, therefore, simulated Bell's Inequality such as (A∩B)∩'C' >(A∩C)∩"B" applying on mixed sample spaces (the sample space of (A∩B)∩'C' is Field Dependent Hidden Variables generated by polarizer B and the sample space of (A∩C)∩"B" is Field Dependent Hidden Variables generated by polarizer C) cannot be used to prove if Hidden Variables exist or not.

A comparison between Bell's Inequality of the same sample space of Hidden Variables and simulated Bell's Inequality of the mixed sample spaces of Hidden Variables and Field Dependent Hidden Variables can be shown as follows:

For the same sample space of Field Dependent Hidden Variables, Bell's Inequality based on Set Theory can be formulated as follows (Fig. 1) (Table 1):

(A∩B)∩C = (A∩C)∩B

(A∩-C) ≤ (A∩-B) + (A∩B)∩-C

(A∩B)∩C ≤ A∩C

Where ∩ is "AND Operation" in Set Theory based on the same sample space. All elements (photons and electrons) stay unchanged (maintain the same Hidden Variables) during AND operations.

However, in optical polarization (for photon) and magnetic polarization (for electron), with mixed sample spaces based on Principle of Normalization, simulated Bell's Inequality can be obtained as follows:

(A∩B)∩'C' >(A∩C)∩"B"

(A∩-C) > (A∩-B) + (A∩B)∩'-C'

(A∩B)∩'C' > A∩C

Where ∩ is "AND Transformation", ∩' and ∩" are "Normalized AND Transformations". (A∩B), (A∩-B), (A∩C) and (A∩-C) have the same sample space of the original Hidden Variables. The sample space of (A∩B)∩'C' is Field Dependent Hidden Variables generated by polarizer B (Fig. 2) and the sample space of (A∩C)∩"B" is Field Dependent Hidden Variables generated by polarizer C.

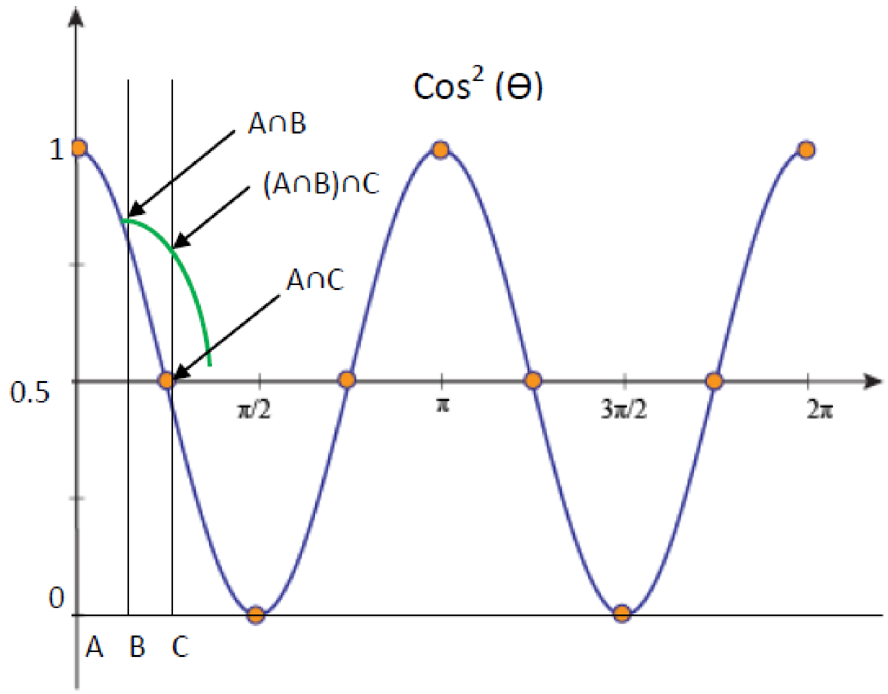

Fig. 2 The effects of different sample spaces on Bell's Inequality in photon polarization experiments. (A∩C) < (A∩B)∩C is due to the mixed sample spaces Hidden Variables and Field Dependent Hidden Variables.

It is obvious that different sample spaces give different sets, so that (A∩B)∩'C' is bigger in sample space of Field Dependent Hidden Variables than A∩C in sample space of Hidden Variables (Fig. 2). Therefore the results of simulated Bell's Inequalities obtained from the mixed sample spaces are different compared to that of the Bell's Inequality obtained from the same sample space. As a result, the claim "There are no Hidden

Variables in photons and electrons" based on the results obtained from simulated Bell's Inequality in mixed sample spaces is inconclusive.

X. Quantum Entanglement Experiments (Same Sample Space)

According to Set Theory, in the same sample space, all elements with hidden variables should fulfill Bell's Inequality. Therefore, the whole purpose of those Quantum Entanglement Experiments is trying to find one exception which doesn't meet Bell's Inequality so as to prove that Hidden Variables do not exist in entagled electrons and phtons.

In Quantum Entanglement Experiments, all elements (entangled electrons with Hidden Variables) are coming from the same sample space (space of Hidden Variables) generated by an electron source. The polarizers are used to form sets with electron positioning either inside the set (spin up) or outside the set (spin down). Since all these sets are formed by the elements (electrons) from the same sample space of Hidden Variables (light source), therefore Bell's Inequality should always hold for these sets and the existence of Hidden Variables can be proved. But, in reality, because of the inaccurate analysis, a number of false results are reported which have caused a lot of misunderstandings and confusions.

In Electron Entanglement Experiments, a pair of entangled electrons is generated from an electron source and is emitted separately to the electron spin detectors in Alice's and Bob's laboratories. Three magnetic polarizers with polarization angles 120^o apart from each other ($P_1=\Phi$, $P_2=\Phi+120^o$ and $P_3=\Phi+240^o$, where Φ is the angle between the original electron e and P_1 polarizer at Alice's laboratory) are used for detection and each time a magnetic polarizer is randomly chosen by Alice and Bob respectively for measurements.

There are two different types of electron sources, coherent and random. Also there are two different sets of polarizers, Alice and Bob can use the same set ($P_1=\Phi$, $P_2=\Phi+120^o$, $P_3=\Phi+240^o$), or Bob can use the opposite set ($P_1=\Phi+180^o$, $P_2=\Phi+300^o$, $P_3=\Phi+60^o$).

1. Coherent Electron Source

Because the possibility to find the same spin as that of the original electron passing through a magnetic polarizer at angle Θ is $\mathrm{Cos}^2(\Theta/2)$ (Fig. 3) [6], where Θ is the angle between the magnetic polarization directions of the original electron and the magnetic polarizer. Therefore, the total possibilities P (Φ) to find the same spin as the original electron from a coherent electron source passing through either one of the three polarizers (Φ, $\Phi+120^o$, $\Phi+240^o$) (Fig. 3) can be calculated as follows:

$$P(\Phi) = [\mathrm{Cos}^2(\Phi/2) + \mathrm{Cos}^2(\Phi/2 + 120^o/2) + \mathrm{Cos}^2(\Phi/2 + 240^o/2)]/3$$

Because

$$\mathrm{Cos}(\Theta+\Phi) = \mathrm{Cos}\,\Theta\,\mathrm{Cos}\,\Phi - \mathrm{Sin}\,\Theta\,\mathrm{Sin}\,\Phi$$

Therefore,

$$P(\Phi) = 50\%$$

As a result, with coherent electron source, the possibility to find same spin as the original electron passing through either one of the three magnetic polarizers (Φ, $\Phi+120^o$, $\Phi+240^o$) is always 50%.

2. Random Electron Source

The possibility to find the same spin as the original electron passing through either one of the above three magnetic polarizers (Φ, $\Phi+120^o$, $\Phi+240^o$) from a random electron source is the average of the integration of $P(\Phi)$ from 0 to 2π,

$$P = 1/2\pi \int 1/3[\mathrm{Cos}^2(\Phi/2) + \mathrm{Cos}^2(\Phi/2 + 120^o/2) + \mathrm{Cos}^2(\Phi/2 + 240^o/2)]\, d\Phi$$

$$P= 50\%$$

As a result, with random electron source, the possibility to find electrons with the same spin as the original electron passing through either one of the three magnetic polarizers (Φ, $\Phi+120^o$, $\Phi+240^o$) is also 50%.

3. Opposite Polarizers

Furthermore, the entangled electron goes to Alice's laboratory is spin up and measured randomly by either one of the three magnetic polarizers (Φ, $\Phi+120^o$ and $\Phi+240^o$), and the other entangled electron goes to Bob's laboratory must be spin down and is measured randomly by either one of the opposite set of three magnetic polarizers (Φ+180°, Φ+300°, Φ+60°). For both coherent source and random electron sources, the possibility that Bob will find spin down electrons is 50% (spin up electrons also 50%). As a result, the total possibility that Alice and Bob will find the same spins (both spin up) is 50%. Also, the total possibility to find the opposite spins (Alice spin up and Bob spin down) is again 50%.

4. Same Polarizers

Assuming Bob using the same set of magnetic polarizers as Alice, then two cases are studied here: Case A (Φ = 0°), where the polarization direction of the original entangled electron "e" coming to Alice's laboratory is the same as P_1 magnetic polarizer; and Case B (Φ = 180°), where the polarization direction of the original entangled electron "e" coming to Alice's laboratory is opposite to P_1 magnetic polarizer.

a. Case A (Φ = 0°)

In case the polarization direction of P_1 magnetic polarizer is the same (Φ = 0°) as the original electron "e" coming to Alice's laboratory, then Fig. 3 shows the possibilities of finding spin up electrons with either of the three magnetic polarizers in Alice's laboratory (the original electron "e" is spin up) and the possibility of finding spin down electrons in Bob's laboratory (because of the entanglement, the original electron "e̲" coming to Bob's laboratory is spin down). Where P_1, P_2 and P_3 are the three magnetic polarizers having angles 0°, 120° and 240° apart from the polarization direction of "e" in Alice laboratory, and 180°, 300° and 60° apart from "e̲" in Bob's laboratory.

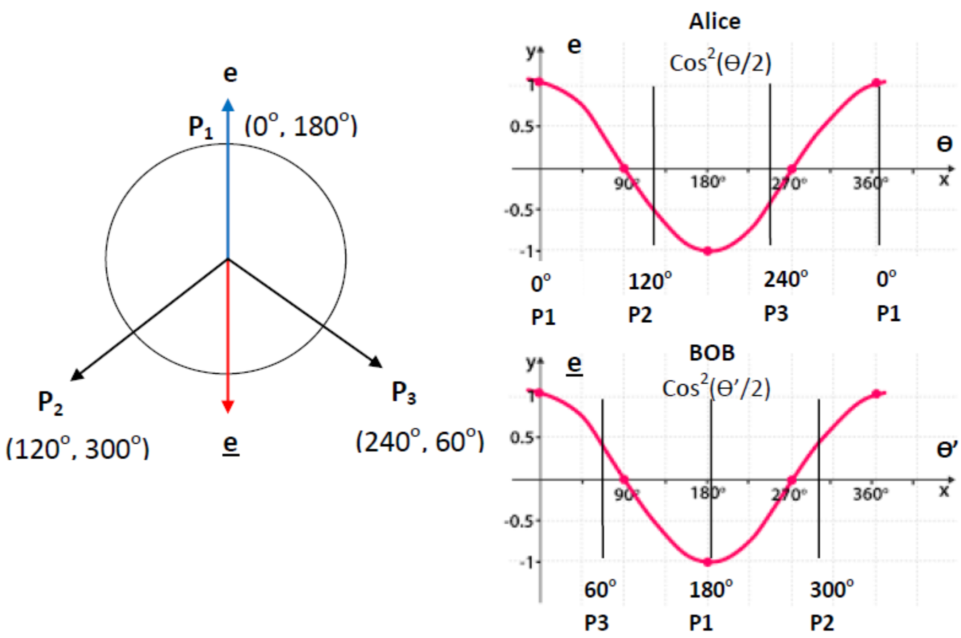

Fig. 2 The possibilities of spin up for Alice's and spin down for Bob's laboratories.

Table 2 shows the possibilities of finding opposite spins with different combinations of magnetic polarizers (P_xP_y) between Alice's and Bob's laboratories. Where P_U is the possibility of finding spin up in Alice's laboratory and spin down in Bob's laboratory, and P_D is the possibility of finding spin down in Alice's laboratory and spin up in Bob's laboratory.

Table 2. The possibilities of opposite spins observed by Alice and Bob at Φ = 0°. (Where Φ is the angle between the original electron (spin up) and P_1 polarizer at Alice's laboratory)

Polarizers	Alice e↑	Bob e↓	P_U	Alice e↓	Bob e↑	P_D	P_U+ P_D
P_1P_1	$Cos^2(0°/2)$	$Cos^2(180°/2)$	0	$1- Cos^2(0°/2)$	$1-Cos^2(180°/2)$	0	0
P_1P_2	$Cos^2(0°/2)$	$Cos^2(300°/2)$	3/4	$1- Cos^2(0°/2)$	$1-Cos^2(300°/2)$	0	3/4
P_1P_3	$Cos^2(0°/2)$	$Cos^2(60°/2)$	3/4	$1- Cos^2(0°/2)$	$1-Cos^2(60°/2)$	0	3/4
P_2P_1	$Cos^2(120°/2)$	$Cos^2(180°/2)$	0	$1- Cos^2(120°/2)$	$1-Cos^2(180°/2)$	3/4	3/4
P_2P_2	$Cos^2(120°/2)$	$Cos^2(300°/2)$	3/16	$1- Cos^2(120°/2)$	$1-Cos^2(300°/2)$	3/16	6/16
P_2P_3	$Cos^2(120°/2)$	$Cos^2(60°/2)$	3/16	$1- Cos^2(120°/2)$	$1-Cos^2(60°/2)$	3/16	6/16
P_3P_1	$Cos^2(240°/2)$	$Cos^2(180°/2)$	0	$1- Cos^2(240°/2)$	$1-Cos^2(180°/2)$	3/4	3/4
P_3P_2	$Cos^2(240°/2)$	$Cos^2(300°/2)$	3/16	$1- Cos^2(240°/2)$	$1-Cos^2(300°/2)$	3/16	6/16
P_3P_3	$Cos^2(240°/2)$	$Cos^2(60°/2)$	3/16	$1- Cos^2(240°/2)$	$1-Cos^2(60°/2)$	3/16	6/16

For example, with P_2P_3 combination (Alice uses P_2 magnetic polarizer and Bob uses P_3 magnetic polarizer),

$P_U = Cos^2(120°/2)\,Cos^2(60°/2) = (1/2)^2\,(3^{1/2}/2)^2 = 3/16$

$P_D = [1- Cos^2(120°/2)]\,[1- Cos^2(60°/2) = (3/4)\,(1/4) = 3/16$

$P_U + P_D = 6/16$

Therefore, the total possibility P of finding opposite spins between Alice and Bob can be calculated as follows:

$P = 1/9\ \Sigma(P_U + P_D)$

$P = 50\%$

As a result, in case the polarization direction of the original electron coming to Alice's laboratory is the same as P_1 magnetic polarizer (Φ = 0°), then the total possibility of finding opposite spins between Alice and Bob is 50%, and the total possibility of finding the same spins is also 50%.

b. Case B (Φ = 180°)

In case the polarization direction of P_1 magnetic polarizer is opposite (Φ = 180°) to the original electron "e" coming to Alice's laboratory, then Fig. 4 shows the possibilities of finding spin up electrons in Alice's laboratory (the original electron "e" is spin up) and the possibility of finding spin down electrons in Bob's laboratory (because of the entanglement, the original electron "e" coming to Bob's laboratory is spin down). Where P_1, P_2 and P_3 are the three polarizers with angles 180°, 300° and 60° apart from "e" in Alice's laboratory, and 0°, 120° and 240° apart from "e" in Bob's laboratory.

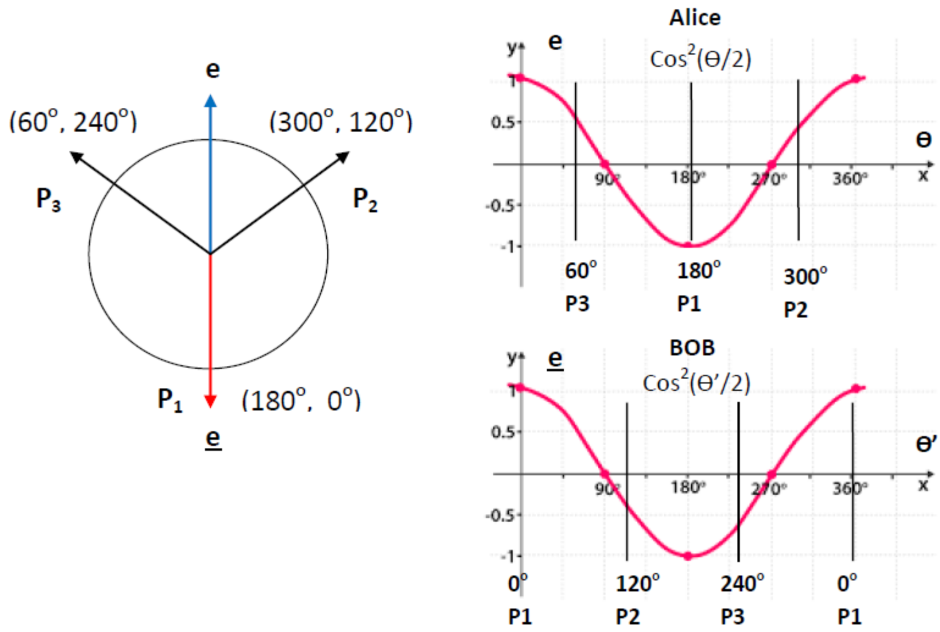

Fig. 3 The possibilities of spin up at Alice's and spin down at Bob's laboratories (at Φ = 180°, Φ is the angle between the original electron e (spin up) and P_1 at Alice's laboratory).

Table 3 shows the possibilities of finding opposite spins with different combinations of magnetic polarizers (P_xP_y) between Alice's and Bob's laboratories. Where P_U is the possibility of finding spin up in Alice's laboratory and spin down in Bob's laboratory, and P_D is the possibility of finding spin down in Alice's laboratory and spin up in Bob's laboratory. Therefore,

$P = 1/9\ \Sigma(P_U + P_D)$

$P = 50\%$

Where P is the total possibility of finding opposite spins between Alice's and Bob's laboratories.

As a result, in case the polarization direction of Alice's P_1 polarizer is opposite (180°) to the original electron coming to Alice's laboratory, then again the total possibility of finding opposite spins between Alice and Bob is 50%, and the total possibility of finding the same spins is also 50%.

Table 3. The possibilities of opposite spins observed by Alice and Bob at Φ = 180°. (Where Φ is the angle between the original electron (spin up) and P_1 polarizer at Alice's laboratory)

Polarizers	Alice e↑	Bob e↓	P_U	Alice e↓	Bob e↑	P_D	$P_U + P_D$
P_1P_1	$Cos^2(180°/2)$	$Cos^2(0°/2)$	0	$1- Cos^2(180°/2)$	$1- Cos^2(0°/2)$	0	0
P_1P_2	$Cos^2(180°/2)$	$Cos^2(120°/2)$	0	$1- Cos^2(180°/2)$	$1-Cos^2(120°/2)$	3/4	3/4
P_1P_3	$Cos^2(180°/2)$	$Cos^2(240°/2)$	0	$1- Cos^2(180°/2)$	$1-Cos^2(240°/2)$	3/4	3/4
P_2P_1	$Cos^2(300°/2)$	$Cos^2(0°/2)$	1/4	$1- Cos^2(300°/2)$	$1-Cos^2(0°/2)$	0	1/4
P_2P_2	$Cos^2(300°/2)$	$Cos^2(120°/2)$	1/16	$1- Cos^2(300°/2)$	$1-Cos^2(120°/2)$	9/16	10/16
P_2P_3	$Cos^2(300°/2)$	$Cos^2(240°/2)$	1/16	$1- Cos^2(300°/2)$	$1-Cos^2(240°/2)$	9/16	10/16
P_3P_1	$Cos^2(60°/2)$	$Cos^2(0°/2)$	1/4	$1- Cos^2(60°/2)$	$1-Cos^2(0°/2)$	0	1/4
P_3P_2	$Cos^2(60°/2)$	$Cos^2(120°/2)$	1/16	$1- Cos^2(60°/2)$	$1-Cos^2(120°/2)$	9/16	10/16
P_3P_3	$Cos^2(60°/2)$	$Cos^2(240°/2)$	1/16	$1- Cos^2(60°/2)$	$1-Cos^2(240°/2)$	9/16	10/16

Most Bell's Inequality experiments take 50% - 50% spin up and spin down possibilities for each photon and electron with Hidden Variables measured by each polarizer, instead of $Cos^2(\Theta/2)$ for spin up electrons and $Cos^2(\Theta)$ for spin up photons. It is obviously a big mistake. Therefore, the claims that "Because the experimental results don't fulfill Bell's Inequality, therefore Hidden Variables don't exist" are totally false. In fact, with correct data, all experimental results should fulfill Bell's Inequalities subject to the theoretical calculation. As a result, Hidden Variables should exist in both entangled electrons and photons. In other words, Schrodinger's Cat couldn't be both alive and dead at the same time. Also, there should be no Superposition, neither spooky behavior.

XI. Conflicts in Quantum Mechanics

According to Yangton and Yington Theory, both wave and particle properties (Wave Particle Duality) can coexist in a spinning polarized particle such as a photon or electron, no matter the environment and location. In Double Slit Interference experiment [8], particle detector can be used to influence the phase angles of particle waves such that the interference patterns can be diminished or even cancelled. However, this experiment can't be used to prove the nonexistence of wave properties. Therefore, "Complementarity" meaning "both wave and particle properties cannot coexist while being observed or measured simultaneously" is not true.

In addition, for both photon and electron with their predetermined quantum energy states (Hidden Variables), energy can be added to electron or removed from photon through an interactive transformation process (optical polarization or magnetic polarization). Also subject to the threshold energy depending on the strength of the polarization (the angle of polarization), they can be moved to a new quantum energy states (Field Dependent Hidden Variables) either remaining the same spin mode if original energy state is lower than the threshold energy or flipping of to the opposite spin mode if original energy state is higher than the threshold energy. (In case of photon polarization, low energy photons are blocked out by the threshold energy – the transformation energy barrier). Also, according to Principle of Normalization, both photons and electrons can be transferred further to normalized quantum energy states (Normalized Field Dependent Hidden Variables) through further transformations.

Because different quantum energy states can be generated through polarization processes which makes different sample spaces. Also, Bell's Inequality is based on Set Theory which can only be applied on the same sample space. Therefore the simulated Bell's Inequality applying on the mixed sample spaces cannot be used to prove if Hidden Variables or Field Dependent Hidden Variables exist or not. On the other hand, for Quantum Entanglement experiments applying on the same sample space of Field Dependent Hidden Variables, Bell's Inequality can indeed prove the existence of the Hidden Variables. Therefore, Schrödinger's Cat cannot be both alive and dead at the same time."Quantum Superposition" also cannot be true.

Furthermore, in Quantum Entanglement, both entangled photons (and entangled electrons) have the same Hidden Variables except in opposite spin directions. Also under the same polarization processes (measurements), they both gain or lose the same energies and pass through the same threshold energy barriers to get to the same Field Dependent Hidden Variables. Therefore, they are always entangled no matter how far the distance and how fast the time are. Everything is predetermined, there is no mystery, no surprise and certainly no "Spooky" behavior.

Even though Quantum Mechanics has been misinterpreted by several famous scientists in the past millennium, also a serious challenge has been raised to against Superposition Theory and Complementarity Principle – the heart of Quantum Mechanics, still Quantum Mechanics is a very well established scientific theory based on the quantized properties of particles and the probability and statistic natures of multiple quantum states.

XII. Conclusion

According to Yangton and Yington Theory, all photons and electrons have predetermined quantum energy states (Hidden Variables). During photon polarization and electron magnetic polarization processes, their quantum states (Hidden Variables) can be changed either by adding energy to electron or reducing energy from photon to become a new quantum states (Field Dependent Hidden Variables). For further transformation (polarization processes), according to Principle of Normalization, a normalized quantum energy states can be achieved (Normalized Field Dependent Hidden Variables). Since Bell Inequality based on Set Theory can only be applied on the same sample space, therefore, for polarization experiments applying on the mixed sample spaces (Hidden Variables and Field Dependent Hidden Variables), Bell's Inequality cannot be used to prove if Hidden Variables exist or not. On the other hand, for Quantum Entanglement experiments applying on the same sample space of Hidden Variables, Bell's Inequality can be used to prove the existence of the Hidden Variables (A detailed analysis is studied in this paper). Furthermore, since both entangled photons (and entangled electrons) have the same Hidden Variables except in opposite spin directions. Under the same polarization processes (measurements), they both gain or lose the same energies and pass through the same threshold energy barriers to get to the same Field Dependent Hidden Variables in opposite directions. Therefore, they are always entangled no matter how far the distance and how fast the time are. The existence of Hidden Variables fulfills Bell's Inequality which raises a big challenge to Quantum Superposition and Quantum Entanglement.

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