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Single Slit Diffraction and Double Slit Interference Interpreted by Yangton and Yington Theory

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[Abstract]: *According to Yangton and Yington Theory, only spin particles such as photon and electron can have wave particle duality. Appling particle waves in study of Single Slit Diffraction and Double Slit Interference, a new type of mechanisms: attractive interference and repulsive interference are proposed instead of constructive interference and destructive interference, which gives a better explanation to particle depletion in destructive interference. In case of single particle experiment, subject to the traveling time, direction and distance of each particle, attractive interference and repulsive interference can still happen but at much less frequency. Furthermore, which-way experiment and the Complementarity Principle are proven incorrect and both particle and wave properties on photon and electron can coexist at the same time.*
[Keywords]: *Yangton and Yington, Wu's Pairs, Photon, String Theory, Electron, Wave Particle Duality, Single Slit Diffraction, Double Slit Interference. Constructive Interference, Destructive Interference, Attractive Interference, Repulsive Interference.*

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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:

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

$$E_{Creation} + E_{Circulation} \leftrightarrow \text{Yangton } \Phi \text{ Yington}$$

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. $E_{Creation}$ is Energy of Creation which is used to generate Force of Creation. $E_{Circulation}$ is the circulation energy which includes both potential and kinetic energies of the circulation. The summation of $E_{Creation}$ and $E_{Circulation}$ is called "Wu's Pair Formation Energy" which can be generated either from Big Bang explosion [7].

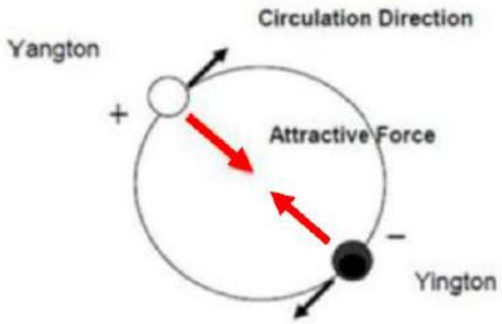

Fig. 1 Wu's Pair - a Yangton and Yington circulating pair.

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 $3x10^8$ 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].

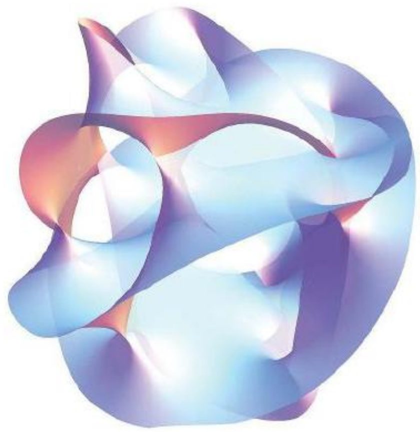

Fig. 2 A cross section of a quintic Calabi-Yau manifold.

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.

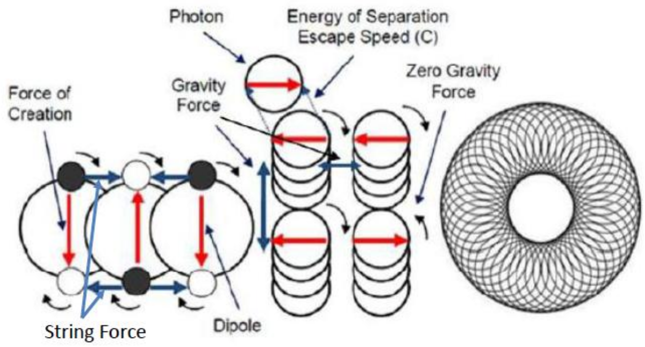

Fig. 3 Wu's Pairs stack up in a preferred direction by string force to form string and ring structures.

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].

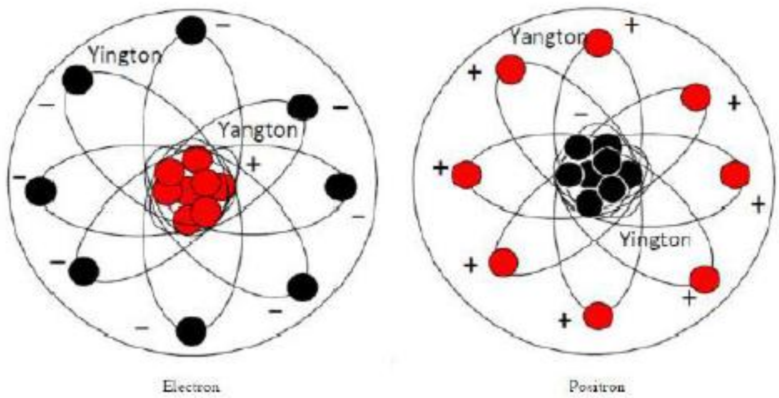

Fig. 4 Hypothetical structures of electrons and positrons.

II. Diffraction and Interference

Diffraction and interference are phenomena observed with all waves having a specific property varied periodically along their traveling paths, such as water and sound waves – continuous displacement carried by water and air, electromagnetic wave – packet of electromagnetic field generated by Yangton and Yington circulation and carried by photon and electron particle wave – packet of angular momentum generated by electron spin and carried by electron, etc.

Interference is caused by superimpose two waves together. Diffraction on the other hand is caused by a wave emitted from a finite source or passing through a finite aperture to spread out as it propagates. Diffraction results from the interference of an infinite number of waves emitted by a continuous source points in two or three dimensions. Huygens' principle lets us treat wave propagation by considering every point on a wave front to be a secondary source of spherical wavelets. These wavelets propagate outward with the speed of the wave. The wavelets emitted by all points on the wave front interfere with each other to produce the traveling wave.

Huygens' principle also holds for electromagnetic waves and electron particle waves. However, based on Yangton and Yington Theory, when studying the propagation of photon and electron, we can replace the wave front by a group of coherent photons and electrons (in phase).

III. Single Slit Diffraction

When light passes through a single slit whose width is on the order of the wavelength of the light, then we can observe a single slit diffraction pattern on a screen that is at a distance away from the slit. The intensity is a function of angle. Conventionally, Huygens' principle tells us that each part of the slit can be thought of as an emitter of waves. All these waves interfere to produce the diffraction pattern. Where crest meets crest we have constructive interference and where crest meets trough we have destructive interference (Fig. 5). On the other hand, based on Yangton and Yington Theory, all particles including non-spin and spin particles emitted from the slit will form an image with normal distribution (Fig. 6). In case of spin particles such as photons and electrons, similar diffraction patterns (Fig. 5) can be generated by attractive and repulsive interferences instead of constructive and destructive interferences (Fig. 9).

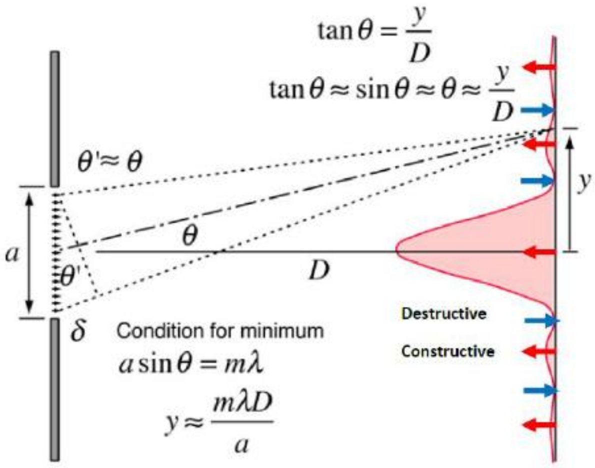

Fig. 5 The mechanism of single slit diffraction based on wave propagation and spin particle radiation.

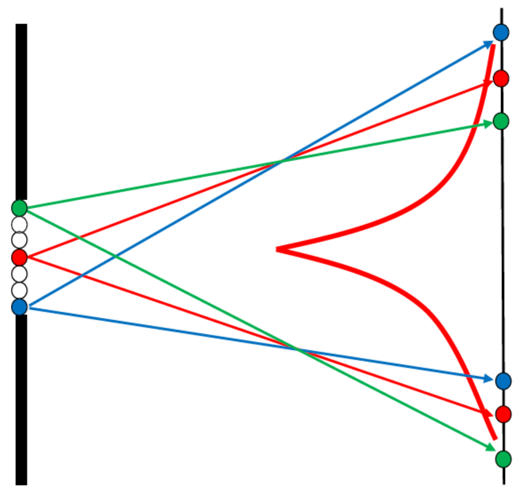

Fig. 6 The image of single slit generated by non-spin particle emission without diffraction.

IV. Double Slit Interference

In modern physics, the double-slit experiment is a demonstration that light and matter can display characteristics of both classically defined waves and particles; moreover, it displays the fundamentally probabilistic nature of quantum mechanical phenomena. This type of experiment was first performed, using light, by Thomas Young in 1801, as a demonstration of the wave behavior of light.

In the basic version of this experiment, a coherent light source, such as a laser beam, illuminates a plate pierced by two parallel slits, and the light passing through the slits is observed on a screen behind the plate. The wave nature of light produces interference (Fig. 7) that would not be expected if light consisted of classical particles.

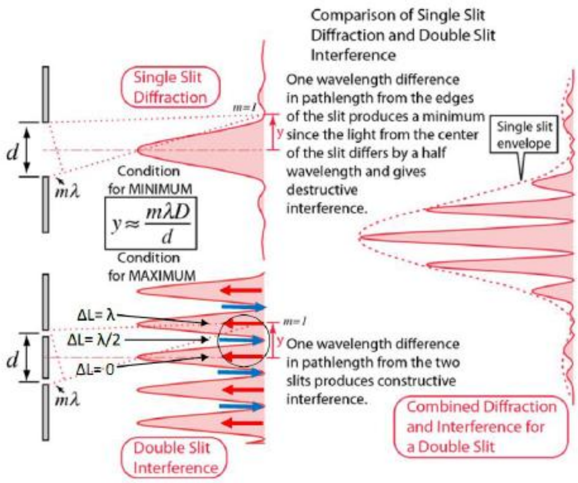

Fig. 7 Single Slit Diffraction and Double Slit Interference.

Other versions of the experiment that include detectors at the slits find that each detected photon passes through one slit (as would a classical particle), and not through both slits (as would a wave) [13]. As a result, two single slit diffraction patterns can be found without interference.

In 1961, Claus Jönsson of the University of Tübingen performed the experiment with electron beams [14]. In 1974, the Italian physicists Pier Giorgio Merli, Gian Franco Missiroli, and Giulio Pozzi repeated the experiment using single electrons and biprism (instead of slits). Sending particles such as electrons through a double-slit apparatus one at a time results in single particles appearing on the screen, however, an interference pattern emerges when these particles are allowed to build up one by one (Fig. 8). This demonstrates the wave particle duality, which states that all matter exhibits both wave and particle properties: the particle is measured as a single pulse at a single position, while the wave describes the probability of absorbing the particle at a specific place on the screen.[15]

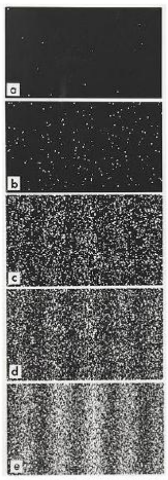

Fig. 8 Step by step build up pattern of electron Double Slit Interference.

This phenomenon has been shown to occur with photons, electrons, atoms and even some molecules, including buckyballs. So experiments with electrons add confirmatory evidence to the view that electrons, protons, neutrons, and even larger entities that are ordinarily called particles nevertheless have their own wave nature and even a wavelength (related to their momentum).

The double-slit experiment (and its variations) has become a classic thought experiment, for its clarity in expressing the central puzzles of quantum mechanics. Because it demonstrates the fundamental limitation of the ability of the observer to predict experimental results, Richard Feynman called it "A phenomenon which is impossible to explain in any classical way, and which has in it the heart of quantum mechanics. In reality, it contains the only mystery of quantum mechanics" [16].

A well-known thought experiment predicts that if particle detectors are positioned at the slits, showing through which slit a photon goes, the interference pattern will disappear.[16] This which-way experiment illustrates the complementarity principle that photons can behave as either particles or waves, but cannot be observed as both at the same time.

An experiment performed in 1987 [17] produced results that demonstrated that information could be obtained regarding which path a particle had taken without destroying the interference altogether. This showed the effect of measurements that disturbed the particles in transit to a lesser degree and thereby influenced the interference pattern only to a comparable extent. In other words, if one does not insist that the method used to determine which slit each photon passes through be completely reliable, one can still detect a (degraded) interference pattern.[18]

V. Mechanisms of Interferences

When two waves of the same kind come together, both constructive interference (crest to crest) and destructive interference (crest to trough) can be formed. However, for particle waves such as photon and electron, what does the destructive interference mean? Does it mean that particles disappeared? Or just the electromagnetic fields and angular momentums diminished? Because most detectors placed at the screen can only detect particle's existence, when there is no signal response, or in other words, when a destructive interference is detected, it simply means that there is no particle appeared at that location. Question is where those particles go? Destroyed? Converted energy? Or depleted? Based on the "Law of Conservation of Mass" that particles cannot be destroyed, and the "Conversion between Mass and Energy" which can only happen in Big Bang and nuclear reaction, the only possible answer is that particles are depleted in region of destructive interference. Therefore, attraction and repulsion are proposed as the mechanisms for the interferences of particles instead of construction and destruction (Fig. 9).

According to Yangton and Yington Theory, when two photons come together side by side, they can attract to each other if they are in phase (Yangton to Yangton), or otherwise they repulse to each other if they are out of phase (Yangton to Yington) (Fig. 9). Similar mechanism can be found in electron particle waves. Because electron can be considered as a small magnet, when two electrons come together side by side, they can attract to each other if they in phase (north to north), or otherwise they repulse to each other if out of phase (north to south) (Fig. 9). Furthermore, for single particle experiment, subject to the traveling time, direction and distance of each particle, attractive interference and repulsive interference can still happen but at much less frequency (Fig. 8).

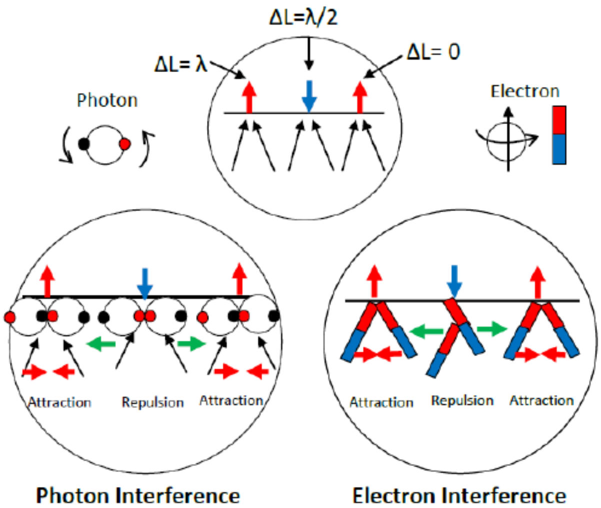

Fig. 9 Mechanisms of photon interference and electron interference.

VI. Interruption of Interference

In the Double Slit experiment, when detectors are used to detect the traveling path of particles, it could change the phases (the magnitude of a specific property) of the particles that passed through the detectors to certain extend such that the interferences can be interrupted and consequently Single Slit Diffraction patters can reveal. This explains the confusions of wave particle duality in Double Slit experiment. It has also proved that "Which-way experiment and the Complementarity Principle that photons can behave as either particles or waves, but cannot be observed as both at the same time" is wrong and both particle and wave properties on photon and electron can be observed at the same time. Furthermore, it explains Richard Feynman's mystery. The possibility to find the particles landed on certain area of the screen is not due to quantum mechanics but the contribution of attractive and repulsive interferences.

VII. Conclusion

According to Yangton and Yington Theory, only spin particles such as photon and electron can have wave particle duality. Appling particle waves in study of Single Slit Diffraction and Double Slit Interference, a new type of mechanisms: attractive interference and repulsive interference are proposed instead of constructive interference and destructive interference, which gives a better explanation to particle depletion in destructive interference. In case of single particle experiment, subject to the traveling time, direction and distance of each particle, attractive interference and repulsive interference can still happen but at much less frequency. Furthermore, which-way experiment and the Complementarity Principle are proven incorrect and both particle and wave properties on photon and electron can coexist at the same time.

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