Another Interpretation of Quantum Mechanics

Robert T. Longo

[1]Principal Scientist, Ph.D. Physicist, Technical Fellow

[2]Advanced Technology, Boeing Company, Torrance, California, Retired

*Presently, Independent Researcher, rtlongo370@gmail.com

Abstract In this paper, I postulate a different way to think of quantum interactions. The concept was first conceived by Freeman Dyson, https:www.dumtp.com ac.uk/user/long/em/dyson.pdf. when he described the electric and magnetic fields defined by Maxwell's theory as abstract quantities that exist as a two-layer system. He then suggested that all fields behave the same, and since the quantum wave function is a probability amplitude field, it is also an abstract field that becomes real and measurable when combined with other fields, such as its complex conjugate. This paper follows Dyson's lead and finds a way to bring Einstein and Bohr debate closer together.

Keywords Copenhagen interpretation, Bohr and Einstein debate, Many worlds interpretation, pilot-wave theory, de Broglie-Bohm theory, transactional interpretation

1 Introduction

Understanding the interpretation of Quantum Mechanics (QM) has been a longstanding challenge in the field of physics. The elusive nature of QM, such as superposition and entanglement, has intrigued scientists for decades. Many different interpretations of QM have been suggested. The first was the Copenhagen interpretation, proposed by Niels Bohr[1] with input from Werner Heisenberg, which suggests that particles exist in a superposition of states until they are observed. At that point, the oscillating function, known as the wave function that describes the particle, collapses into a single state.

The Bohr and Einstein debate[2] centered around the fundamental principles of QM and the nature of reality at the quantum level. Bohr argued for the probabilistic nature of QM, while Einstein believed in a deterministic universe where all events could be predicted with certainty. The debate highlighted the tensions between classical and quantum physics and the philosophical implications of quantum theory. Ultimately, the debate remains unresolved and continues to be a topic of discussion in the scientific community.

Consciousness as an explanation in QM is a controversial topic and is not widely accepted by mainstream scientists. Some proponents of this idea, such as physicist Eugene Wigner, have suggested that consciousness plays a role in the collapse of the wave function in QM. However, this idea is not supported by empirical evidence and is considered speculative by most scientists. It is difficult to pinpoint a specific time when consciousness became an explanation in QM, as it has been a topic of debate for many years.

Along the path to understanding the true nature of QM, there are other interpretations, such as the many-worlds interpretation, proposed by Hugh Everett III[3], which suggests that every possible outcome of a quantum event actually occurs in a separate parallel universe. There are also other interpretations, such as the pilot-wave theory, which sometimes goes by the name of de Broglie-Bohm theory[4]. In this interpretation, the wave function guides the movement of the particle.

The transactional interpretation[5]. According to this interpretation, quantum events are seen as transactions between particles and their environment. In this interpretation, a quantum system is described by a wave function that evolves deterministically according to the Schrdinger equation until a measurement is made. When a measurement is made, a transaction occurs between the system and the measuring device, where resulting in the disappearance of the wave function without a new wave function replacing the old wave function. The transactional interpretation suggests that the collapse of the wave function is not a random or probabilistic event but rather a result of the interaction between the quantum system and its environment. This interpretation has been proposed as a way to reconcile the deterministic evolution of the wave function with the apparent randomness of quantum measurement outcomes. Each of these interpretations offers its own perspective on the nature of QM. These and other interpretations continue to be a topic of debate and research in the field of quantum physics. Richard Feynman famously said about QM,

> "I think I can safely say that nobody understands quantum mechanics."

This statement reflects the complex and counterintuitive nature of QM, which often defies our classical intuition and presents challenges to comprehend fully.
Bohr commented on the strangeness of QM;

> "If you don't think quantum mechanics is strange, you do not understand quantum mechanics"

More recently, Dean Radin's[6], using a double-slit device, investigated the effects of consciousness in QM. Participants were asked to focus their mental intention on either causing the interference pattern (wave-like behavior) or the particle pattern (particle-like behavior) to appear in the double-slit experiment. The results showed that participants were able to influence the outcome of the experiment, suggesting a potential

connection between consciousness and the behavior of particles at the quantum level. This supports the idea that consciousness can not only collapse the wave function but also play a role in shaping physical reality.
In this work, another interpretation will be proposed, which is based on the intellectual observations of Freeman J. Dyson[7]. Dyson's work was an essay on Physical fields. Before we can address our QM interpretation, we must formally reinstate the Human Being as an integral part of the structure of physics. It is the human observer who developed all the theories of physics, and in particular, humans invented QM to understand the microscopic world. Being an integral part of the development of QM, humans need to be part of Physics.

2 Dyson's Essay and application to QM

Dyson's Essay explains why Maxwell's theory took a long time to be understood. Maxwell's theory was understandable only after giving up a mechanical model to explain electric and magnetic fields. Dyson explains that a look at the units of the electric field has units of the square root of a Joule per cubic meter, and there is no way we can directly measure the square root of a joule. Thus, the fields must be considered abstractions. In modern physics, the fields are not only thought to be abstract but also are part of a two-layer system. In the first layer, the fields are determined by differential equations. In the second layer, these fields are combined among themselves, yielding a measurable energy density,

$$u = \frac{1}{16\pi}(\epsilon \boldsymbol{E}^* \cdot \boldsymbol{E} + \frac{1}{\mu}\boldsymbol{B}^* \cdot \boldsymbol{B}). \tag{1}$$

Dyson[7] suggested abstract quantum wave function field $\psi(1)$, where the one represents the spacial coordinates of the wave as a function of time. The probability amplitude wave function is a solution of the Schrodinger differential equation,

$$\frac{\hbar^2}{2m} \bigtriangledown^2 \Psi(r,t) + V(r)\Psi(r,t) = -i\hbar\frac{\partial}{\partial t}\Psi(r,t). \tag{2}$$

The wave function resides in an Euclidean space, which is defined by a tangent space to the GR manifold that represents a solid planet; in this story, it is the Earth. The origin of the tangent space coordinate is the point of origin or interaction of the quantum object under study. The inside of the Earth also remains part of the tangent space since there are particles, such as the neutrino, that can pass through the Earth without interacting.

Once the wave function is obtained by a solution to the Schrodinger differential equation, being abstract, it instantly fills the Universe[1], whose reference origin is at the point of interaction on the manifold. Even if the wave function describes a local phenomenon, it instantly fills the universe.

The wave function field is in the first abstract layer. Using Dyson's unit argument, the wave function Ψ has a unit of the square root of an inverse cubic meter, and clearly, by the same argument, the combined unit can not be measured directly, as was seen from Maxwell's fields and discussed above. However, when combined among themselves, for example, with its complex conjugate then integrated and normalized, a measurable probability of finding the particle at r is obtained as

$$P = \int_{-\infty}^{\infty} \Psi(r)^* \Psi(r) dr^3, \tag{3}$$

This, in part, will provide, using the reinterpretation principle (RTP), a new interpretation of QM.

3 A Brief History of the Human Observer

Quantum Mechanics, it is suggested by some, that consciousness is important in its interpretation; this suggests the importance of the Human observer. However, physics has methodically removed humans from its science. In earlier times, Humans were thought to be at the center of the universe and thus an integral part of God's plan. It was natural for early man to believe he was God's chosen one since, from simple observations, all astronomical objects, the stars, the Sun, the planets, and the moon, clearly rotated around the Earth. It was clear to those people that God had placed man at the center of the universe. As time progressed, man, using his God-given intelligence, invented and advanced his technology so that he could obtain a deeper understanding of the world that God had given him. This technology, however, began to show discrepancies from the simple world he had become accustomed to. He became aware of the strange, retrograde motion of certain points of light in the sky and named them planets. The word Planets means wandering stars. In time, they built a complex model to explain this unusual motion. The ancient Greek mathematician and astronomer Ptolemy, in the 2nd century AD, wrote a comprehensive mathematical and astronomical treatise called Almagest[8] could explain the retrograde motion of the Planets, which is a complex system of many cycles and epicycles. Almagest is considered one of the most important works in the "History of Astronomy" and was the authoritative source on the subject for over a thousand years.

The true source of the retrograde motion of the planets was obtained by placing the Sun at the center of the universe. This was discovered by Nicolaus Copernicus[9] in the 16th century, using data collected by astronomer Tycho Brahe[2]. Copernicus's heliocentric model of the solar system placed the Earth as just another planet rotating around the Sun. This was at first thought to be nonsense since we would certainly feel the motion, which we do not. Then came Galileo[10], who introduced the idea of relativity, which states that we can not feel steady motion. Further, using a new technology, a telescope, Galileo discovered moons rotating around Jupiter; thus, objects can orbit other planets and not just the Sun, further breaking the hold on the religion of the day. These events revolutionized our understanding of the cosmos and laid the foundation for modern astronomy. However, it also removed the Human Being as God's favorite. As time progressed, modern physics has removed human beings from all aspects of physics. These events set the foundation for the mysteries of QM.

[1] The definition of the universe is the space that confines the wave function. In a laboratory experiment, it is the physical volume of the experiment; for a free photon, the universe has its usual infinite definition.

[2] One of Tycho Brahe's greatest accomplishments was not completed until after his death. Working in Prague, Brahe continued to add to his star catalog and create accurate measurements.

In earlier work[11], it was found that the time Newton defined as a measure of time led to anomalies in astrophysics and cosmology. When a physical definition of time was introduced, the anomalies vanished. I postulate that a similar effect is observed in the interpretation of QM. The Human Being, who has been completely removed from the structure of physics, is now becoming an important part of QM. Some physicists currently think that consciousness is important and causes the collapse of the wave function; even though we do not understand it, consciousness remains an open question. In recent times, new revelations about consciousness have appeared in experimental physics; Radin [6], using the double-slit experiment, has demonstrated that thoughts can modify the results of physical experiments. This will be further discussed in section 5.

3.1 The Human Observer

Let us start with a basic thought: where does the Human observer live? Can the conscious observer live anywhere in the Universe? The observer can not live in outer space, or on a gas planet or in the atmosphere of the Earth. He must live on a solid planet, such as the surface of the Earth[3], where sufficient nutrients are available to promote biological growth and evolution. In General Relativity, It is well known that a mass such as a Star, Planet, or Moon can be embedded into Euclidean space[12]. The Euclidean space in which the gravitating mass, in this case, the Earth, is embedded has no physical meaning[13]. However, a quantum wave function, which is an abstract object, can exist anywhere our imagination desires, as does all of Maxwell's fields[7]. The human being's feet are planted firmly on solid ground, where electromagnetic effects prevent his acceleration to the center of the larger gravitational source. The deterministic universe, where all events could be predicted with certainty, gave rise to classical physics, as invented by Newton, which is what Humans imagined should also be true for QM, but it does not appear to be.

4 Dyson quantum structure

Dyson[7] suggested abstract quantum wave function field $\psi(1)$, where the one represents the spacial coordinates of the wave as a function of time for a particular particle. The probability amplitude wave function is a solution of the Schrodinger differential equation.

The wave function resides in an Euclidean space, which is defined by a tangent space to the manifold that represents a solid planet where Humans do their experiments and write their theories; in this story, it is the Earth. The origin of the tangent space coordinate is the point of origin or interaction of the quantum object under study. The inside of the Earth also remains part of the tangent space since there are particles, such as the neutrino, that can pass through the Earth without interacting.

Once the wave function is obtained by a solution to the Schrodinger differential equation, being abstract, it instantly fills the Universe, whose reference origin is at the point of interaction, See footnote 1. Shown in Figure 1, the GR object is seen as a manifold embedded in an infinite Euclidean space. Real physical objects are only measurable, i.e., real, when on the manifold[13]. In this case, the photon is an abstract particle, as is the wave function, and resides off the manifold as it moves. When it is detected by our telescope, someplace on the Earth's manifold, its abstract character vanishes, and its attributes are real and measurable. The photon is a fundamental particle and can not be broken, as defined by Einstein[14] in the explanation of the photoelectric effect. The photon has energy and must give it all to the detector, and it vanishes completely, as does its wave function.

The unit vectors for a reference coordinates system at the point of interaction define the tangent space attached to the GR description of the gravitating body where the photon is launched.

$$e_r = sin(\theta)cos(\phi)\hat{\imath} + sin(\theta)sin(\phi)\hat{\jmath} + cos(\theta)\hat{k} \quad (4)$$

$$e_\theta = cos(\theta)cos(\phi)\hat{\imath} - cos(\theta)sin(\phi)\hat{\jmath} - sin(\theta)\hat{k} \quad (5)$$

$$e_\phi = -sin(\theta)sin(\phi)\hat{\imath} + sin(\theta)cos(\phi)\hat{\jmath} \quad (6)$$

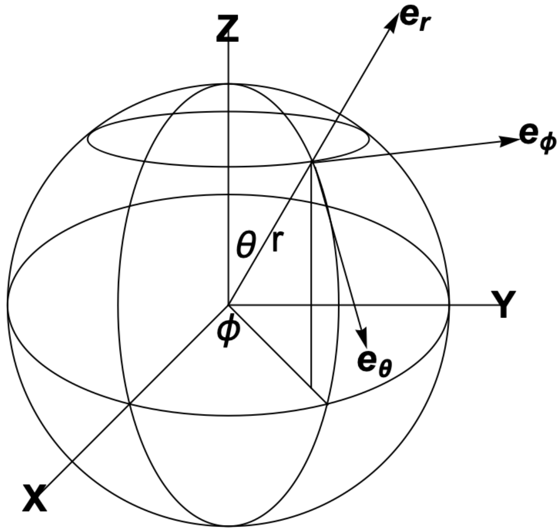

Figure 1. A tangent reference frame e_r, e_θ, e_ϕ is constructed at any point on the Manifold surface, where Human interest is focused. The unit vectors are given with respect to the embedding $\hat{\imath}, \hat{\jmath}, \hat{k}$ of the embedding frame. The tangent space is attached to a world line of the large gravitational mass and instantly fills the universe when created. See footnote1.

The wave function is imagined to remain until the particle represented by the wave function is engaged in another interaction. At that time, the entire wave function instantly vanishes, and a new wave function instantly fills the complete tangent space. If, for example, the interaction is a collision between two quantum objects, then the wave function is defined $\psi(1,2)$[15] where the numbers represent the space coordinates as a function of time for each of the particles and described by a Hamiltonian $H(1,2)$ which is defined for both particles. Particles defined by their wave function in the abstract tangent space are not real but are ghost particles.

At the same instant, the ghost particle appears, and a real particle appears on the manifold containing measurable energy, which continues moving until the next quantum interaction[4].

[3]It is true he can do experiments in an airplane in the atmosphere or in an orbiting spacecraft; these cases are handled by an abstract argument since there are other forces that prevent his continual acceleration due to gravitation.

[4]If the universe, as defined in footnote1, is a laboratory experiment, whose spacial extent $d << R_{Earth}$ then the ghost particle and the real particle for all practical purposes are at the same location.

The particle, upon interacting with the classical detector, deposits its energy and vanishes, leaving it's "signature" at the detector. On the other hand, if the interaction is with another quantum object, such as electron-electron scattering, the initial wave functions vanish, and new wave functions are formed and instantly fill the universe. and ghost particles appear. The real particles on the manifold continue their motion as if responding to a classical force in the expected way. When a particle defined by a wave function encounters a classical measurement apparatus, if the real particle is a massive particle, it deposits all of its kinetic energy into the measurement device; if the particle is massless, a photon it deposits its entire energy into the measurement device and vanishes; in either case, it is not replaced by another wave function. The vanishing wave function is characteristic of the transactional interpretation[5] when a quantum particle encounters a classical measurement device; in either case, the wave function vanishes.

5 The Two Slit Quantum Experiment

Richard Feynman thought:

> "The double slit experiment has in it the heart of QM.
> In reality, it contains the only mystery"

The entire double-slit experimental device is entirely located on the Earth's surface GR manifold, where physics is valid[13]. A coordinate system is erected at the output of the gun for massive quantum quantities or the output of a laser for a massless quantum quantity. The reference frame is tangent to the surface of the Earth, as seen in Figure 1, and the main axis of the experiment is constructed along the e_θ direction, Equ (2). The slit's long axis is along the e_r direction, Equ (1). When the gun fires, the quantum object is an abstract wave function as imagined by Dyson[7] and as determined by the Schrodinger equation. As described in section 2, it instantly fills the Euclidean tangent space universe, see footnote 1, which in this case is the interior of the double-slit device. A physical particle, determined by the wave function, has energy; if a massive particle, its kinetic energy is transferred to the detector; if it is a photon, then its entire energy is transferred to the detector. As the wave function and associated particle pass through the double slit system, they are not observable. But when the particle reaches the detector associated with the screen, it becomes observable.

The experiment begins when the gun fires the quantum object into the experiment; the gun is located at the origin; see Figure 1 and Equations 1,2,3 for the reference frame that can be used for a detailed mathematical description of the experiment. At that moment, the quantum object emerges; it is described as an abstract probability amplitude field, a wave function that instantly extends as an abstract object through all Euclidean tangent space of the universe, see footnote 1. Suppose the orientation of the slit experimental system is aligned along the e_θ direction and the length of the slits along the e_r direction. Suppose further the distance between the particle gun and the slits is d, and the distance from the slits and the screen is the same d. To clarify, suppose momentarily, the double slit device is built on a massive scale, such that d is large compared to the curvature of the Earth's manifold. In that case, the abstract wave function and the particle associated with the wave function are thought of as a ghost particle in the Euclidian tangent space, which is coincident with the real particle on the manifold. The ghost and real particle are at the same point in the embedding space, but the real particle is defined on the GR manifold, and the ghost particle is defined in the GR tangent space. However, from the perspective of the embedding space, they are both at the same point. In this state, it has no reality, meaning it can not be measured. It persists in that state until it interacts with a measurement device, in this case, the screen behind the slits. If the emitted wave function scatter from the edges of the slits, which are classical boundaries, the wave function is not affected but produces diffraction waves. A real massive particle can give up some of its kinetic energy, as does classical light when producing diffraction effects. But when the wave function reaches the screen, it ends its path, meaning it interacts quantum mechanically, gives up all its energy, and vanishes. At that point, the abstract wave function and ghost particle disappear from the universe. As does the real particle on the manifold, leaving behind an altered image on the screen due to its energy, which is totally dispersed into the bulk of the classical screen or the Detector, as described by Feynman[16]. The quantum object gives up its entire energy to the classical measurement device.

When the quantum object interacts with another quantum object, its abstract wave function vanishes everywhere instantly, and a new wave function at that moment replaces it. In this case, the speed of light limitations are irrelevant to the abstract wave function. The new wave function extends throughout the entire Universe at the instant of interaction, see footnote 1. This abstract mechanism is similar to the Copenhagen interpretation in the sense that the wave function is totally modified, i.e., it is similar to thinking it collapses into a new wave function, as thought by the Copenhagen interpretation.

In his essay, Dyson[7] showed why Maxwell's important paper was not well received. It was due to his mechanical interpretation of fields. Eventually, this led to a two-layer system, leaving fields as abstract objects that are not measurable until they are combined among themselves or with other measurable objects. Further, Dyson suggested that the wave function of QM, which also describes a field of probability, is an abstract quantity like Maxwell's fields. In this work, we follow Dyson's lead.

First, we look at the two-slit experiment when classical light is used. When the light passes through the slits, it diffracts, spreading out as it progresses to the screen. at the slits, It loses energy in the sense that it spreads, so its density decreases. It also loses energy to the physical slits as it passes through. In the quantum case, when photons pass through the slits, there is no loss to the slit because a photon is a fundamental particle and can not be broken or reduced. The photon will not lose any energy, or it will lose all of its energy, as Einstein showed when he named the photon and explained the photoelectric effect[14]. This is also further supported by reducing the intensity of photons until only one photon at a time is passed through the two-slit system. Even though the image on the screen is a single point where the photon deposits its entire energy. After many photons pass through the system and many points are visible on the screen, the pattern clearly shows the diffraction pattern expected by a wave, indicating the wave that guides the photon was clearly present.

5.1 Experiment to detect which slit a particle traverses

To determine which slit the particle passes through, a particle detector is placed behind one of the slits to determine which slit the photon passes through[16]. When this is done, the pattern on the screen changes. The interference pattern that is typically observed when both slits are open disappears, and instead, a pattern similar to that of a single-slit experiment is seen. This is thought to be due to the collapse of the wave function, which destroys the interference pattern. In the present interpretation, the wave function does not collapse; it vanishes, giving up its entire energy if it's a photon or its kinetic energy if it is a massive particle. Along with the ghost particle, the real particle on the manifold does not suddenly vanish; it continues to the screen but does not have the wave character and so does not produce interference fringes.

Radin[6], used the double slit device to study Consciousness. Basically, he asked participants to imagine particles passing through the slits for a period of time, then to stop the concentration, and repeat several times. The interference fringe length, top minus the bottom of the line intensities, was measured, and statistics were determined. A result was found that indicated by imagining the particles passing through the slits affecting the outcome. He found some participants who could concentrate for longer periods without mental distraction had the biggest effect. He even introduced the experiment over the internet, allowing persons from all over the world to participate, thus removing the possible effect of physical effect due to the closeness of the participants. Similar results were obtained. The results Radin suggest that consciousness not only collapses the wave function but also modifies the physical results. Walleczek et al. 2019 criticized the Radin experiment[17], indicating that the statistics of very small quantities will produce false positives. Radin et al. responded to the Walleczek critique[18]. Basically, people who could concentrate for longer periods of time had the best results; apparently, when the mind gets distracted, the ability to cause the effect diminishes.

6 Entanglement

Quantum entanglement is a phenomenon in QM where two or more particles become connected in such a way that the state of one particle is directly related to the state of the other, regardless of the distance between them. This means that measuring the state of one particle instantaneously determines the state of the other, even if they are light-years apart. This phenomenon is often referred to as "spooky action at a distance" from Einstein's philosophy. it has been experimentally verified through various tests and experiments. Quantum entanglement is a key aspect of QM and has implications for quantum computing, cryptography, and teleportation.

Quantum particles become entangled when they interact in a way that their quantum states become correlated. This can happen when two particles are created together in a process such as a decay or collision or when they interact with each other in a controlled experimental setup. Once the particles become entangled, their quantum states are no longer independent of each other, and measuring the state of one particle will instantly determine the state of the other, no matter how far apart they are. This phenomenon is a fundamental aspect of QM and has been confirmed through numerous experiments.

6.1 Creating entangled quantum entities

One example of entangled quantum objects is a pair of photons that are created simultaneously and share a quantum state. When one of the photons is measured, the state of the other photon is instantaneously determined, regardless of the distance between them. This phenomenon, known as quantum entanglement, demonstrates the interconnected nature of quantum particles and is thought to define the non-locality aspect of QM.

Photons are created through various processes, such as electromagnetic radiation, particle decay, and atomic transitions. In some cases, photons can be created simultaneously through processes such as stimulated emission in lasers or in certain types of particle interactions. In these cases, multiple photons are generated at the same time, resulting in their simultaneous creation.

To create entangled photons, a process called spontaneous parametric down-conversion can be used. This involves sending a high-energy photon through a nonlinear crystal, which splits the photon into two lower-energy photons that are entangled. These entangled photons will have correlated properties such as polarization or direction of propagation. This process is commonly used in quantum optics experiments to create entangled photon pairs for various applications in quantum information processing and quantum communication.

The Einstein-Bohr debate about entanglement was a famous and long-standing disagreement between Albert Einstein and Niels Bohr regarding the implications of quantum entanglement. Quantum entanglement is a phenomenon in which two or more particles become connected in such a way that the state of one particle is directly linked to the state of another, regardless of the distance between them.
Einstein believed that quantum entanglement implied the existence of "spooky action at a distance," where information could be transferred instantaneously between entangled particles, violating the principles of relativity. He argued that there must be hidden variables at play that determined the outcomes of measurements and that QM was an incomplete theory.
Bohr, on the other hand, embraced the probabilistic nature of QM and rejected the idea of hidden variables. He argued that entanglement was a fundamental feature of the quantum world and that the concept of locality, where events can only influence their immediate surroundings, did not apply at the quantum level.
The debate between Einstein and Bohr continued for many years. It highlighted the deep philosophical and conceptual differences between their views on the nature of reality and the interpretation of QM. Ultimately, experiments in the following decades confirmed the predictions of quantum entanglement and supported Bohr's interpretation, leading to the acceptance of entanglement as a fundamental aspect of quantum physics.

6.2 Experiments done to prove entanglement

There have been several experiments conducted to prove the phenomenon of entanglement in QM. One of the most famous experiments is the Bell test, which was proposed by physicist John Bell in the 1960s[19]. In a typical Bell test experiment, two particles are prepared in an entangled state such that their properties are correlated. These particles are then separated and sent to two distant locations, where measurements are made on each particle. According to QM, the measurements made on one particle should instantaneously affect the properties of the other particle, even if they are separated by large distances. To prove entanglement, the experimenters must show that the correlations between the measurements of the two particles are stronger than what classical physics can explain. This is typically done by performing a statistical analysis of the measurement outcomes and comparing them to the predictions of QM. By conducting multiple repetitions of the experiment and analyzing the results, researchers can demonstrate that the entangled particles are indeed correlated in a way that cannot be explained by classical physics. This provides strong evidence for the existence of entanglement and the non-local nature of QM.

6.3 Other experimental methods to prove entanglement

A few examples of experimental techniques used to demonstrate entanglement in quantum systems. Each technique provides different types of evidence for the existence of entanglement, but together, they form a strong body of evidence supporting the reality of this phenomenon.

1. Quantum state tomography: This technique involves measuring the full quantum state of a system, which can reveal entanglement through correlations between the measured properties of the system.

2. Quantum teleportation is a process in which the state of one quantum system is transferred to another distant system without physically transmitting the state through space. This process relies on entanglement between the two systems.

3. Quantum entanglement swapping: This technique involves creating entanglement between two particles that have never directly interacted by using a third particle that is entangled with each of the original particles. This demonstrates the non-local correlations that are characteristic of entanglement.

6.4 Another explanation of how entanglement is explained

Using Dyson's explanation that wave function fields are abstract quantities, we can write for the entanglement process

$$H(1,2)\Psi(1,2) = i\hbar\frac{\partial}{\partial t}\Psi(1,2) \tag{7}$$

Where the wave function $\Psi(1,2)$ describes the time-dependent space variables of the two particles, and $H(1,2)$ is the Hamiltonian for each particle[5], and time in the time derivative is the same for both particles. The abstract wave function, $\Psi(1,2)$, as discussed earlier, upon interaction, is created everywhere in the universe, in the tangent space of the Earth where the entanglement happened. Now let us suppose that on Earth, where the entanglement took place, the Human observer measures particle 1. The wave function $\Psi(1,2)$ vanishes and a new wave function $\phi(2)$ of the yet-to-be-measured particle instantly appears everywhere in the universe.

Now, suppose a human observer based on the moon measures particle 2, $\phi(2)$. Particle 2 vanishes and is not replaced since it deposits its entire energy into the measurement device, as discussed in section 3. The moon observer transmits the result back to Earth. If the measurements of particle 1 on Earth and particle 2 on the moon are measured at the same time, using synchronized clocks, and the result is transmitted from the moon to the Earth along with the clock time the measurement was made, the result will appear to be spooky action at a distance. There will not be a delay due to the speed of light, as Einstein thought there should be. Now, the wave function $\phi(2)$ vanishes and is not replaced since it deposits its entire energy into the classical measurement device.

7 Discussion

In Dyson's essay[7] on Maxwell's paper on electrodynamics, he indicated that Maxwell's physical interpretation introduced complications that were very hard to understand. Thus, Maxwell's paper was not taken seriously. His paper only gained the respect it deserved after the concepts of fields were considered abstract quantities. Dyson then suggested that the wave function of QM, which is the field of probability amplitudes, will make the fundamental concept of QM easier to understand. That was at the heart of the Einstein-Bohr debate. To implement Dyson's suggestion, we had to start by formally bringing the Human Being, the observer, into physics and defining where he can live. He can only live on a solid gravitating body whose electromagnetic properties stabilize him to the surface of the body. We take this solid body to be the Earth and assume it can be embedded into Euclidean space as a manifold[12][13]. All real properties, i.e., measurable properties, reside on the manifold. The abstract quantities reside in the Euclidean tangent space of the manifold. Fill out the entire universe; see footnote 1. Quantum bodies associated with the abstract wave function are also abstract and are thought of as ghost particles. However, the real particle counterpart materializes on the manifold and is measurable and evolves as if responding to real, measurable physical forces.

In this implementation, when quantum objects interact, their abstract wave function, which is defined by the Schrdinger differential equation, instantly exists in the entire tangent space universe, irrespective of the speed of light. Upon a second quantum interaction, the first wave function vanishes, and another wave function instantly replaces it, which is characteristic of the collapse of the wave function in the Copenhagen Interpretation. The real particles on the manifold move as if responding to a physical force with no unusual jumps at the moment of interaction.
The double slit experiment becomes easier to understand because it exists from the instant a photon is released from the laser. The photon, which is a fundamental quantum entity and can not be broken apart, can not lose energy to the slits upon diffraction but loses all of its energy when interacting with the

[5]For the use of this notation, see[15].

classical detector; a similar argument was used by Einstein to explain photoelectric emission[14].

Quantum entanglement also becomes understandable since the total abstract wave function contains the time-dependent coordinates of both particles. and propagates throughout the Universe as one. When one of the particles is measured, the combined abstract wave function bifurcates, and the measured part vanishes, leaving the particle that has yet to be measured. When the second particle is measured, the entire wave function vanishes.

As a final remark, interpretations of an observed phenomenon depend on the language used to describe the observation. This is why there is virtually no difficulty with the language of mathematics when describing QM. The importance of using the appropriate language is also clearly realized by virtually every person who has experienced a phenomenon called Near-Death Experience (NDE)[20]. All stated that there were no words to describe what was experienced and observed.

8 Acknolegement

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