Consciousness and Quantum Physics

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Caution: This paper only represents scientific opinions for people who are seeking for a plausible interpretation about the truth of being "alive." In other words, they are only trying to explain something that God made Billion years ago. These are only some philosophical ideas supported by experiments still not fully understood, yet. Dr/ Richard Feynman said and I quote "If you think you understand quantum physics, you don't understand quantum physics."

Abstract

During the past century, the theory of quantum mechanics was raised and became one of the three fundamental theories that the humanity uses to describe all the observed phenomena. This theory mainly describes the physical properties of nature at the scale of atoms and subatomic particles. Besides its stunning interpretations, there is still a huge part of it uncovered, for example the measurement problem. A Countless number of experiments and theories were conducted trying to understand the wavefunction and some of the theories from great scientists tried to connect between the wavefunction collapsing and the conscious awareness of the human brain. Despite all the explanations, all of them still have conflicts, like Von Neumann-Winger Interpretation and many others. This paper discusses the most important ideas that connect between the quantum mechanics and the human awareness.

I. Introduction

Nobody understands what consciousness is or how it works; nobody understands quantum mechanics either. Could that be more than a coincidence? Trying to explain where subjective experiences come from would seem to have little to do with physics. Some scientists, however, have speculated that perhaps the deepest levels of theoretical physics contain the insights needed to illuminate this question by suggesting that quantum physics can be used to explain the very existence of consciousness. There is more than one approach to the concept of Conciseness—from philosophy to neuroscience and the study of the brain—; however, I will try to explain it in the sense of Physics, specifically the quantum physics.

II. Copenhagen Interpretation and the double-slit experiment

To understand the link between conciseness and quantum mechanics, we need to go back to one of the earliest interpretations about quantum physics: Copenhagen interpretation. In this theory, the quantum wave function collapses due to a conscious observer making a measurement of a physical system. John Archibald Wheeler purposed that the entire universe collapsed into the state we see specifically because there had to be conscious observers present to cause the collapse. Therefore, any possible universes that do not contain conscious observers are automatically ruled out. In other words, it is

possible that our mind converts some waves and infinite possibilities to a specific, defined object that we see and feel that in order generates the human conciseness. The origin of this idea came from the classic example of the double-slit experiment. This experiment is done by shooting a number of electrons at a pair of slits; they pass through the slit and then registered on a detector wall on the other side (shown in figure 1)

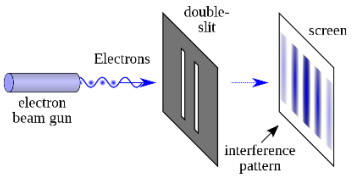

Figure 1: Double-Slit Experiment

The uncommon thing is that the electrons registered at the detector form a series of bands. The produced pattern is the same pattern done by wave passing through the slits, also known as interference pattern (Shown in figure 2).

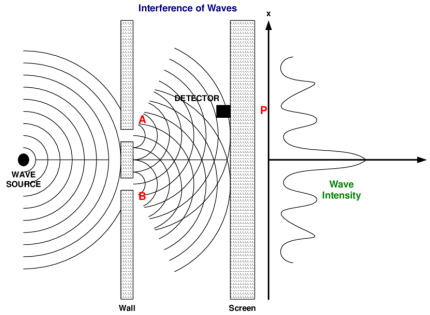

Figure 2: Interference Pattern

It can be inferred that every electron has been guided to stick on a particular site of the detector independently. It can also be inferred that every single electron has to know the entire wave pattern, which also means that the electron passes through the two slits simultaneously. The Copenhagen interpretation comes here to say that the electron doesn't travel as a particle or a wave along these slits; however, it travels as a "probability wave" or something we call wavefunction (Shown in figure 3).

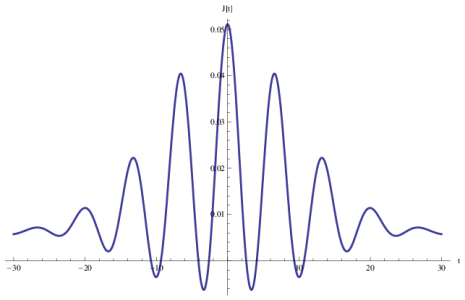

Figure 3: Wavefunction

That wavefunction defines the locations of the electrons at any point if you are trying to measure it: when we make the measurement, the wavefunction collapses from infinite possibilities of the location of the electron to a definite spot on the detector. [1]

III. The Measurement Problem

A question that raised up after the double-slit experiment is simply "When the transition of the quantum state to the classical one actually happened?" To answer this question, we have to carefully examine the processes that happen in the experiment. The electron wavefunction passes through the two slits then reaches the detector where it stimulates another electron on the detector in this particular location that electron in order begins a cascade of electron impulses that generates electric current along the circuit to the computer then it appears at the screen of the computer. The information provided by the computer travels via photons to light-sensitive molecules in our eyes that initiate electrical signals to our visual cortex and other parts of the brain (Shown in figure 4).

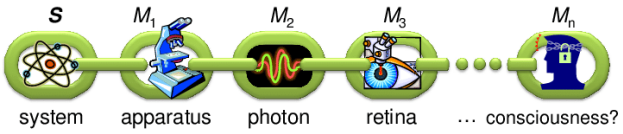

Figure 4: von Neumann chain

This whole process results in a subjective sense of chosen place of the electron on the detector. This chain of information —from the detector to

our cortex— a von Neumann chain. From the provided information, we can conclude that the wavefunction collapse happens somewhere between the measuring apparatus and our consciousness of the measurement. One common thing between all the possible answers of "Where the wavefunction collapse exactly happens?" is that it happens in the particular place that made out of atoms; the von Neumann chain is actually a chain made out of quantum objects. So, we still don't know where exactly that transition happens. That raises up an open question about "The Measurement Problem." [2]

IV. Von Neumann-Winger Interpretation

In 1961, Winger wanted to conduct an experiment to prove that conciseness plays a role in the wavefunction collapse. The Winger's friend experiment was conducted by making the exact same procedure for conducting the double-slit experience except for this time you weren't the one observing the results, your friend was. When the experiment was completed and your friend was aware of the spot of the electron on the detector, before this result reaches your conscious awareness, it has to be in your friend's conscious awareness first. Therefore, there is a moment that, from your point of view, your friend was in a quantum superposition state: means that your friend's mind exists in every single probability of the electron position on the detector. Only when your friend tells you the results of the experiment, his brain, from your perspective, collapses into a single outcome. At the same time, your friend didn't feel that superposition state. From the results of this experience, we can conclude that different observers experience a wavefunction collapsing of the same thing at different times. Therefore, the conscious plays a role in the wavefunction collapsing. This conflict raised numerous philosophical thoughts. [3]

V. The Human Brain Vs. AI

In 1989, seeking for using Quantum physics to explain the nature of the conciseness, Roger Penrose wrote his book "The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics." This book was mainly arguing with the Artificial Intelligence researchers who believed that the brain wasn't more than a computer that they could simulate it. In his book, Roger argues that the human brain is way more sophisticated than they thought. Instead of behaving as a normal binary system computer -On and off-, he argues that the human brain is something more similar to the quantum computers which work with computations that are in a superposition of different quantum states at the same time, rather than run through a written algorithm. This claim supports the idea that we are the only controllers of our future and it's only determined by the results of what we do. [4]

VI. Conclusion

Consciousness is the gift that humans received from their creator. It is needed to create the physical reality and the subjective truth we experience in our life. It makes our external reality meaningful even if it is only made by our minds and there nothing as the objective existence. For sure, Finding the scientific plausible interpretation for the concept of consciousness will be something be splendid. It will assist us to know who we are, from where we came, and where we will go. Non-countable numbers of books and experiments were conducted to try to find the explanation of this conflict, but there is still no define an interpretation for it. Hopefully in the current century, we will find the answers to all of our questions.

VII. References

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