International Research Journal of Multidisciplinary Science & Technology
www.irjmrs.com ISSN : 2455-930X

THE COLLAPSE OF THE WAVE FUNCTION AND ITS IMPLICATION

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ABSTRACT:

Quantum mechanics is a successful theory with regard to the experimental confirmations of its predictions, but it has, from its origins, raised a great controversy regarding the interpretation of its foundations. The debates surrounding the foundations of quantum mechanics provoke continuous controversies from the beginning of the theory to the present day. One of the main reasons for this is in the interpretation of the concept of wave function collapse, which leads to a series of speculations about the application of quantum mechanics in several other areas of human knowledge.

Keywords: quantum mechanics, wave function, collapse, implications.

1. INTRODUCTION:

Heisenberg, Schrodinger, and Dirac are among the physicists who helped develop the mathematics of quantum physics and clung only to the question of mathematics and not to the question of interpretation. An example of this attitude was the Danish physicist Niels Bohr, who was not interested in the details of the atom, but only in describing its behavior, since everything was contained in the mathematical formula.

In quantum mechanics the evolution(1) of a closed system is described by a "state" that evolves in time according to the Schrödinger equation, however, unlike classical theory, this state in general provides only the "probabilities "of obtaining different results of a measurement.

Mathematically, the wave function is represented by the symbol (Ψ), which is the general solution for the Schrodinger equation, obtained by the weighted sum of all possible characteristic solutions of said equation.

All we can say (1) is that the wave function that describes a quantum object contains the potentialities of that object. A sea of infinite possibilities, that philosophers try to interpret, understand and explain what this mathematics describes.

However, when the metering apparatus couples to this mixed system, they evolve into a single entangled state, i.e., a global state function. In this case such generalized systems may also be the experimentalist and the apparatus with the system to be measured.

2. THE ACT OF OBSERVATION AND THE COLLAPSE OF THE WAVE FUNCTION:

According to Copenhagen's interpretation of quantum mechanics, the wave function evolves according to the Schrödinger equation in a linear superposition of different states. However, in the measurement process, the actual measurement always finds a certain value, which means that the measurement did something about the process in question, causing the function to collapse.

Explaining better, we can say that when the wave function collapses, in the presence of an observer, the initial state formed by the superposition of many self- states unfolds to a single particular self-state relating to that measurement. This characterizes the collapse of the wave function.

Heisenberg (2) was the first to point out the inevitable disturbance caused by the observer in the atomic system being observed, by justifying his relationships of indetermination through experience.

Bohr was the one who had the initiative to write about the inevitable interaction between the agent of observation and the atomic system, giving importance to the fact that the observation considerably disturbs the system. Effectively, is there interference of the subject in the observation of quantum phenomena with their implications for the realism and objectivity of the measurement process?

But in cases of simultaneous observations, it cannot be said that both observers end up choosing. So what criteria can help us figure out which of the observers you choose?

The idea that human consciousness would cause the collapse of a particle arose in the 1930s, at a time when some considered eminent the emergence of a scientific revolution in biology and psychology, just as it had in physics.

According to Max Jammer(3), it was the Hungarian mathematician John von Neumann in 1932 who put forward the idea that human consciousness would cause the collapse of the wave function of a particle.

London and Bauer launched a book in 1939 titled The Theory of Observation in Quantum Mechanics, where they present an interpretation of the quantum theory according to which human consciousness would be responsible for the collapse of the quantum wave.

Later on, this idea gained the support of several renowned physicists(3) such as Eugene Wigner, Fritz London, and most recently Henry Stapp, Freeman Dyson, Roger Penrose and Fred Alan Wolf. As is usual in science, some researchers see a new field of research with Promising perspectives; others find that it is not worth investing in this path.

Of all these names, Eugene Wigner, who in 1961 published several non-specialist articles in which he argued that human consciousness would play an essential role in quantum physics, and that the mind would still be a reality not achieved by the physics of his time.

3. THE EXPERIENCE OF WIGNER'S FRIEND:

Wigner's friend(4) is the name of a paradox, theoretically proposed by Hungarian physicist and mathematician Eugene Wigner, a Nobel laureate in 1963. It is an experience of thought that is considered an extension of Schrödinger's cat experiment. The central question is the instant of the collapse of the wave function. According to the Copenhagen interpretation, the collapse of the wave function occurs when the system is observed. Then, premeditatedly, Wigner is absent from the room where the experiment is performed, asking his friend to make the observation. Then, when Wigner returns to the room he may know the result of the experiment. It is as if the material mechanism were replaced by the friend's consciousness, which implies that the state of the system is a linear sum of the possible states.

Wigner(4) asks his friend to communicate the results of the experiment later. Is your friend part of the measuring equipment? Now, if it is the conscious observer who causes the collapse of the wave function, it is the conscious observer who chooses the result of the collapse by his will.

Will the wave of the quantum experiment will suffer a collapse when the friend observes it? Or will Wigner's friend be suspended from vital functions until Wigner asks him the result? In other words, who chooses, Wigner or your friend.

Some scholars believe that the paradox of Wigner's friend arises because of a misunderstanding of consciousness. In a way, we can conclude that the experiment shows that Wigner believed in a unique, cosmic consciousness, as necessary to the measuring process, where all of us are interconnected. Using these controversies allowed by the varied interpretations of quantum mechanics, Capra, Goswami and Maharishi, among others, propose the existence of an Intelligent Universal Field, a Universal Mind, with all the possibilities that determine our reality.

4. CONSCIOUSNESS AND NATURAL PROCESSES:

Based on differences of interpretation quantum mechanics, David Bohm(7) created a theory that later led him to develop the idea that there is a holism in the world. This gave reason to believe that, in recent years, the quantum mechanics was incorporated by the human sciences, worldviews mystical, spiritual, etc.

There has been much written in an attempt to put ideas of quantum physics and spirituality in human relations, but for now, just a little analogy, because quantum theory is far from being understood in its entirety.

Some authors consider that a company keeps as living beings, because they are formed by people and then to the quantum view they can be useful for businesses. Although widespread, this approach is regarded by most physicists simply as a metaphorical use of quantum physics.

Thus, in 1959, BOHM related his ideas about quantum mechanics to Krishnamurti philosophical thinking and, from that, he proposed dialogues between the human sciences and physics.

David Bohm defines holomovement as a dynamic process of wholeness, a single, unbreakable integrity in flowing motion. Everything is connected to everything and in dynamic flow; each part contains the flow as a whole. We can consider holism as the basic nature of reality.

Several authors assume that consciousness can exert a direct influence on natural processes and seek to show how a quantum model of consciousness would account for this and other types of phenomena, and that the observer has a decision-making power.

Some physicists(5) are even bolder and defend a more radical view, in which the human observer himself enters a quantum superposition.

Thus, following this model we can say that, on the quantum scale, who creates reality is the observer, that is, the act of observing that defines reality.

Due to the radical modification of the picture of the world introduced by theory and the new role assigned to the observer, quantum physics has attracted the attention of philosophers.

Today, with the diffusion of the cultural movement called quantum mysticism, the term "quantum" has acquired a new meaning. It does not only designate physics that describes atoms, radiation and molecular structure, but any more mystical attitude, in which individual spirituality is seen as integrating holistically, that is, without separations from the more global spirituality.

The term "quantum" was adopted by the mystical and philosophical currents to attribute to its conceptions a supposed scientific foundation. However, we know that this rationale is controversial, and rejected by most scientists working in orthodox science. In fact, such a mystical conception has nothing to do with the original quantum physics; it acts more in the metaphorical sense.

FINAL CONSIDERATIONS:

Was consciousness a quantum phenomenon? For more forced this speculation may seem, it has been seriously considered by several researchers (5, 6, 7) in the last five years.

The motivation for this approach is that, since consciousness is something mysterious in the same way as quantum phenomena, then these two mysteries can be connected.

However, this study is still at an embryonic stage in neuroscience that makes use of quantum physics considerations.

It is important to emphasize the question of whether consciousness is associated to a quantum phenomenon is basically an empirical question, still open, and that a precise formulation of this fact requires philosophical clarifications concerning the definitions of "consciousness" and "quantum phenomenon".

BIBLIOGRAPHIC REFERENCES:

[1]. PESSOA JUNIOR, O. Concepts of quantum physics. Publisher: Bookstore of Physics, São Paulo, São Paulo, 2006.
[2]. HALLIDAY, D., RESNICK, R. and WALKER,J. Fundamentals of Physics, v.4 - 4th edition, Rio de Janeiro; Technical and Scientific Books Publishing company, 2011
[3]. JAMMER, M. The Philosophy of Quantum Mechanics, John Wiley & Sons (1974).
[4]. WIGNER, EP Remarks on the Mind-Body Question, text available in – http://www.informationphilosopher.com/solutions /scientists/wigner/Wigner_Remarks.pdf,access in20/06/2017.
[5]. HAMEROFF S.; PENROSE R., Consciousness in the universe. Phys Life Rev; 11(1):39-78, 2014
[6]. FREIRE JÚNIOR, O. A story without an ending: the quantum physics controversy 1950-1970. Science & Education, 12, p. 573-86, 2003.
[7]. BOHM, D. A suggested interpretation of the quantum theory in terms of "hidden variables", I and II. Physical Review 85 (2): 166-79 e 180-93, 1952.

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