Scientific and Social Research

Research Article

The Impact of Quantum Mechanics on the Old Paradigm of Physics

Xueheng Wei

Yunnan University, China

Abstract: Quantum mechanics is more revolutionary than relativity theory. How does quantum mechanics impact the paradigm of classical physics? Although both Einstein and Bohr raised relatively vague questions about the old paradigm of physics, such as Einstein's question about differential equations and Bohr's use of "blind crutches" to question the cognitive function of experimental instruments. But there has been no outright skepticism.

Keywords: Einstein; Bohr; Quantum mechanics; Philosophy of physics; Differential equations; The experiment; Paradigm

Publication date: September, 2020
Publication online: 30 September, 2020
****Corresponding author:*** Weixue Heng, 1306399323@qq.com

1 Introduction

The view of science as truth or approaching truth is based on the scientific method alone. First, there is a distinction between the observation-based approach of science and the intuitive approach of the mind. Secondly, in the scientific observation method, the experimental method is distinguished from the ordinary imprecise observation method. Finally, in scientific concepts, propositions and theories, the methods of formal logic are distinguished from dialectical logic, the mathematical methods of formal logic are distinguished from those of non-formal logic, and the mathematical methods are distinguished from those of non-mathematical methods.

The Copenhagen interpretation of quantum mechanics, to a certain extent, is to question or refute and discard the methods of physics, and to restore the equal status of all kinds of methods from the more thorough connotation of relativity. The method of physics is the fundamental paradigm of scientific method. Based on the Copenhagen interpretation of quantum mechanics, this paper reflects its impact on the old paradigm of physics. Bohr's "complementary principle" first impinged on formal logic and greatly appreciated the Chinese "Yin Yang fish". Next, we will reflect on the impact of quantum mechanics on mathematics and experiments.

2 The impact on "understanding the world by mathematics"

This problem is mainly embodied in the fact that the wave function itself has no physical meaning, that is, the mathematical form itself exists as a pure form.The wave function itself follows the Schrodinger equation, and the Schrodinger equation is not the equation of the physical quantity itself, which is not the same as Newton's second law or Maxwell's equations.

The development history of quantum mechanics also gives the mathematical equation first and then gives the explanation of the physical meaning. In the absence of a physical image, the mathematical form can still be performed to derive the physical equation. When the mathematical form is complete, the interpretation of the physical meaning is given again, the new physical image is given, and the limits of the use of classical concepts are given. This proves that mathematics itself can serve as a purely formal function of non-real concepts. Like logical rules, mathematics is based on simulacra and artificial conventions. The further back the system goes, the more formal the mathematics becomes.

What is mathematics? In 1931, Godel put forward his famous Godel incomplete theorem to prove the impossibility of complete logical explanation of mathematical foundation from the inside of mathematical system. The dream of mathematics being explained as pure reason, or simply reduced to "a priori analytic judgment", is shattered. The last bastion of reason, the foundation of mathematics, must be understood in terms of the synthetic relationship between experience and reason. Mathematics, as Lacastor pointed out, is "quasi-empirical". However, for the whole history of Western mathematics, "quasi-experience" alone is not enough to explain the whole picture of Western mathematics. In the later development of mathematics, Chinese and Western mathematics more reflected the rational structure characteristics of "concept is the free creation of thinking"[1].The more obvious this construction is, the more the mathematical system itself embodies the characteristics of "symbol game". On the one hand, such mathematics is used to understand the world, far from the real world; On the other hand, such mathematics cannot be applied to everyday life experiences. The impossibility of logic on the basis of mathematics leads to the doubt of western reason itself, which leads to self-denial. The exclusion of experience and the fundamental view of rationalism that the rules of reason themselves are a priori and not agreed upon have also gone completely into self-denial. The idea of mathematical geometry as a rational paradigm, which began with Plato, was broken.

The mathematical concept of a microscopic particle apart from a decimal cannot be defined, or more precisely defined. In the sense of the smallest observation scale of a person's eye of about "0.1mm", the microscopic object beyond this boundary never appears from the human vision. How to prove the objectivity of its microscopic world? It is only by adding the theory of the micro world to the instrument that the so-called observation of the micro world can be achieved, which is not reliable. It is all too easy for people to make the mistake of imagining a microcosmic process in their minds, and to be convinced of the existence of a microcosmic counterpart given in the theory. Like Mach, Reichenbach saw the fictionality of the microscopic world. "If the term 'observable' is used in a strictly epistemological sense, then it must be said that no quantum mechanical event is observable; Quantum mechanical events are all inferred from macroscopic materials, which constitute the only basis for human perception."[1] Like the mathematical concept of infinity, it is clearly a construction of thought, with no object.

The use of "i" forms the mathematical basis of the formal system of quantum mechanics. It is impossible to express a quantum state without "i", especially after the mode of wave function is squared, "i" is eliminated again. The wave function itself is not a real number, and the mathematical process of square modulus is a real number completely eliminates the incompatibility of "wave" and "particle" in the formal system, because the wave function expresses nothing."i" itself has no reality, and it makes the wave function exist in the pure form of a Hilbert multidimensional geometric space. However, the space of quantum mechanics is the space of abstract waves and does not exist in the real sense, while general relativity holds that it is real, which is also a kind of fiction. After the formal system of quantum mechanics came the statistical interpretation, and it can be said that the use of "i" itself has determined the statistical interpretation. General relativity, like quantum mechanics, is based on the use of "i", a theory of theoretical feasibility made up of mathematical foundations. Mathematics is the construction of the theory itself, and the philosophical and physical meanings are added later. General relativity was also established on the mathematical basis of Einstein's "search for a multi-dimensional group of transformations", and concepts such as "curvature of space" are fictional or, in Einstein's words, freely created.

Mathematics is not only a construction method of the form of equations, but also a construction method of conceptual image construction in classical physics as well as an observation method of experimental observation. The most obvious example is that the concepts of "particle" and "displacement" are clearly empirical archetypes corresponding to mathematical concepts of "point" and "line". So that's the mathematical thinking that goes into the experimental observation, the observation that we just have to focus on a few points and how they move and coincide. For example, when we measure the length of an object with a ruler, we don't look at its color, we don't look inside it, we touch its hardness, we just look at where the ends of the object coincide with the ruler, and the points on the ruler we mark with algebraic symbols, and we end up writing down this length algebra. Of course, algebraic representations of color, interior, and hardness make mathematical observations of the same properties with other instruments. In this way of observation, the phenomenon is reduced to a simple, geometric cutting, and the other components are eliminated, leaving only the geometric components. As a result of the cutting, different objects can be reduced to the same concepts, the same laws. The fact is that empirical phenomena are not originally like this, and we have cut them to have the representation of universality, but the mistake is that we take the universality as the phenomenon itself and ignore the particularity of the phenomenon. Basically, the cut image is not the phenomenon itself, it is just a process of using the method. Mathematical observation means that we simplify and cut phenomena.

This mathematical approach to observation has no cognitive priority. Hieroglyphics have the same function as this, but the hieroglyphics are more specific to the shape and structure of things, which are essentially a function of simulation, simplification and cutting（It can be inferred that different logics are rooted in different languages, and formal logic is rooted in alphabetic languages）.The difference is that mathematical observation, based on the observation of "point" motion and coincidence, understands everything as mechanical motion. The physical equation itself is only a functional relationship established between different measurements in this way, and it does not give the cause of the phenomenon, and it is not the phenomenon itself. Should we abandon the physical ideal of finding "mathematical equations"? In response, Einstein said, "More than once it has been suggested that the laws of nature cannot necessarily be described by differential equations."[2] If it is not a differential equation, what kind of mathematical or other way to replace it? What is clear is that we need a more revolutionary paradigm in physics. In ancient China, the River Maps and Luo Book used discrete Numbers to understand the whole universe, which could be used as a new direction of physics paradigm.

3 The impact on "understanding the world by experiment"

The Copenhagen interpretation of quantum mechanics takes "the unpredictable interaction between the measuring instrument and the measuring object" to the height of the "quantum postulate", which shows the importance of measurement in theory. "In quantum theory," says Bohr, "we demonstrate that the logical generalization of the unexpected regularities that govern atomic phenomena requires us to recognize the fact that no clear-cut distinction can be drawn between the independent behavior of the object and its interaction with the measuring instrument; The measuring instrument specifies the frame of reference to be used."[3] Bohr regarded subject and object as a whole, and measuring object and measuring instrument as a whole. To reduce this sense from the microscopic world to all experiments measured with instruments, then, involves a reinterpretation of the experiment itself. Bohr vividly used the "blind crutch" to describe the role of instruments in understanding the world.

What is the experiment? An experiment is a method of observation in which one person or several persons make measurements with measuring instruments designed and made by human beings. The internal purpose of experimental observation is: certainty, stability, repeatability. The purpose of this approach is the logical certainty requirement derived from formal logic. The goal of achieving this "certainty" is to mathematize the experimental apparatus. On the one hand, the instrument is relatively stable and repeatable, and can be produced in batches. On the other hand, our observations of the instrument are merely "mathematical data". So experiments are complementary to "understanding the world through mathematics". Why should we treat certainty as the core of observation and exclude uncertainty? Is there any reason to treat experimental observation as valid observation and to exclude ordinary observation? What reason do we have to take the knowledge gained from experiments as an explanation for other observations? For example, take a ruler and measure the length, width and height of an apple and get a solid geometry model. Look at the apple directly with the naked eye and get a general impression. Is there any good or bad between this model and this overall impression? Can the former be used as an explanation for the latter? Which is closer to the original apple? In addition to the agreement on methods, we have no reason to explain that experimental observation has cognitive priority and centrality, and there is no reason to explain that general observation has no discourse power.

Not only is the measuring process inseparable from the instrument, but it is also inseparable from the person, without the participation of the experiment will not happen. Therefore, the experiment is not a phenomenon objectively shown to people by nature.

Experiments are closely connected with people, without the operation of people, the experimental process will not happen. Thus, the objectivity of observations obtained through experiments is rather rare. If "God" is the cause of natural phenomena, then experimental phenomena are the result of the joint action of "God" and "man". From the point of view of human design, there are infinite possibilities in the design of instruments and in the design of experimental processes. Due to the maintenance or "superstition" of theory, scientists design experiments that conform to the theory and select experimental processes that conform to the theory, thus eliminating the undesirable "imprecise experiments", "deviant experiments" or "error experiments". In essence, these experiments are all equal, and the subjective selectivity of the experiment is the same as the subjective design of the instrument, with the heavy addition of artificial preferences or theoretical preferences. Any scientific experiment carries with it the subjective wishes of man and the subjective designs of man. The experiment is not purely objective.

Through the analysis of "the method of understanding the world by experiment", we come to the following conclusion: on the one hand, the use of instruments for experiments is in line with the "mathematization" process of nature, which is an artificial process of technical practice and operation; On the other hand, the nature known by experimental methods is not the "original nature", which is different from the "naked eye observation". Therefore, in order to return to the "original nature", we should abandon the "alienation" caused by the "instrumental" experimental process. Quantum mechanics has always been associated with consciousness, and the first person to do so was Von Neumann, who introduced the "projection hypothesis," and then the collapse of the wave function was associated with human consciousness[4].

We have already analysed that instruments are a means of understanding the world, and that they have no particular cognitive priority over original observation. Through instruments, we know only a technological world. The series of world changes brought about by technology are rooted in the primacy of this approach to understanding the world. In fact, the instrument is a mathematical process. Only by measuring the instrument can we get accurate data and form mathematical equations. This is not to say that nature itself is mathematical, but that we make it conform to our mathematics. And the logical nature of western mathematics shows that its system itself has great artificial creativity. In this way, we let nature correspond to this mathematical creativity of man. Fundamentally the original nature of the forgotten and alienation.

4 Conclusion

The depth of the theory of quantum mechanics reveals the problems existing in the old paradigm of physics. "We must remember that what we observe is not nature itself, but the way we approach the problem[5]. "This "method of inquiry" is now understood as the method prescribed by the old paradigm of physics: formal logic-math-experiment. This is the crutch with which we see the world, and it determines how we see our world. And primordial nature does not manifest itself in this way, so this "crutch" keeps us away from primordial nature.

According to the Chinese philosopher Lao Zi, "Tao of nature", the original nature will reveal its most profound "Tao"[6]. In this view, we should abandon the set of mathematical and experimental methods which have been used to understand our nature since Galileo, and give nature itself as it shows itself. Under the background of modern technology becoming more and more detached from nature, the original nature and the "Tao" enlightened by it should be given new attention and understanding.

The development of physics needs a new paradigm and a direction of philosophical thinking. The absence of quantum gravity theory is a "crisis" in physics, "This is why some scientists, including myself, working as I do on quantum gravity, are more acutely aware of the importance of philosophy for physics"[7]."Science is at its best when it remains singularly committed to the goal of evolving paradigms and, in so doing, focusing scientists' unwavering aspirations on the Truths that extend perpetually beyond their wildest imaginations[8]." "Tao of nature" is just a concise statement of the philosophical thought of this new paradigm of physics[6].

References

[1] Reichenbach H. Philosophical Basis of Quantum Mechanics[M]. Beijing: Commercial Press, 2015, 33-34.

[2] Einstein A. Einstein Anthology[M]. Beijing:commercial press, 2009, 261.

[3] Bohr N. Selections Of Niels Bohr's Philosophy[M]. Beijing: commercial press, 1999, 161.
[4] Von J. Neumann Mathematical Foundation of Quantum Mechanics[M]. Prinction, N.J.(1955), Chap 6.
[5] Heisenberg W. Physics and Philosophy: Revolution In Modern Science [M]. Beijing: commercial press, 1981, 24.
[6] Lao Zi. Translation by Jiadeyong[M]. Shanghai: ShanghaiSanlian Books, 2013, Chapter 25.
[7] Carlo Rovelli. Physics Needs Philosophy. Philosophy Needs Physics[J]. Foundations of Physics, 2018, 48(5).
[8] Timothy MG. Mind Bombs: Searching for Truth in the Great Debate Between Einstein and Bohr[J]. Studies in Sociology of Science, 2013, 4(3).