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Rethinking of Quantum Mechanics Based on Heidegger's Philosophy

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Abstract: The essay examines the probability Heidegger's philosophy offers for interpreting quantum mechanical theories. The idea of "Dasein" in Heidegger's philosophy is compared with quantum theory to support the assertion of measurement as reality in quantum mechanics. The essay examines the non-transparency of quantum physics and applies Heidegger's philosophy to explain the unconventional quantum theories under this nature. The retrocausality theory in quantum physics is connected with Heidegger's theory of time, his tripartite framework of states of being and their interconnection in his philosophy. The lack of free will is demonstrated in both Heidegger' philosophy and quantum mechanics by drawing comparisons between the "Thrownness" of "Dasein" into the world and the superdeterminism hypothesis of quantum physics. This essay increases the scope for using Heidegger's philosophy to comprehend quantum physics.

Keywords: Heidegger, Dasein, Time, Quantum Mechanics, Measurement, Retrocausality, Superdeterminism

1. Introduction

In the 20th century, we have seen revolutions in both physics and philosophy. In physics, quantum mechanics is undoubtedly the leading one. It not only explains bizarre phenomena in nature, like black-body radiation but also takes an important role in technologies like circuits and lasers. In philosophy, Heidegger, the German philosopher, challenges the work of philosophers in thousands of years. His philosophy challenges the fundamental route of Western philosophy and innovatively raises being to the center of philosophical research. He pointed out that our philosophy has ignored or avoided the question of being all the time and put time parallel to being in his famous book Being and Time. Combining the two most influential theories in both fields can thus yield new perspectives in both the philosophy of physics and physics.

In history, philosophy has a deep connection with physics. Hegel looked closely at the development of physics when developing his own philosophy of nature, including physics concepts like aether in his own philosophy. Famous quantum physicist Schrodinger also paid great attention to philosophy, no matter the philosophical interpretations of waves described by his own equation or philosophy of oneness. In this paper, I follow this tradition and apply Heidegger's philosophy to reinterpret important phenomena in quantum mechanics, the micro-world. Combining philosophy and physics together can add broader empirical explanations to Heidegger's philosophy and also offer philosophical explanations and support for bizarre phenomena in quantum physics.

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At present, most studies on Heidegger's philosophy focus on comparing his theories with those of other philosophers, such as Stiegler, Husserl, Hegel, etc. Heidegger's philosophy has also affected various fields beyond philosophy, including fields like literature, psychology, and theology, but its connection with physics has been relatively ignored. Attempts to combine Heidegger's philosophy and physics, particularly quantum physics, can be crucial for both the philosophy of physics and physics itself. Cathryn Carson pointed out that after contemporary events like World War II, Heidegger realized the limitation of physics, particularly its capacity to reflect on its method [1]. Science needs philosophy's guide. As instrumentalism of science rises, which questions whether science can touch on the objective truth or simply serve as a tool for humans to predict and classify the world, phenomenology, the study of objectivity or reality in general through subjective living and experiencing, can thus enrich science. In other words, the philosophy of physics, particularly quantum mechanics, is incomplete without phenomenology [2]. Thus, phenomenologist Heidegger's philosophy should be valued in our understanding of quantum mechanics phenomena.

This essay is based on Heidegger's book Being and Time and a previous analysis of Heidegger's philosophy on physics. I went further to discuss three important aspects of quantum mechanics, the measurement problem, the theory of retrocausality, and the theory of superdeterminism. The discussion serves as an inspiration for future attempts of connecting Heidegger's philosophy with quantum physics, including but are not limited to the three ideas discussed in this paper.

2. Measurement as Reality

When quantum mechanics is at its beginning stage, it faces queries on its counterintuitive phenomena, like the uncertainty principle or the spooky action at a distance in quantum entanglement. Einstein, from a dogmatic realism perspective, challenged this unreal nature of quantum mechanics and said that "physics is an attempt conceptually to grasp reality as it is thought independently of its being observed" (Einstein, 1949). This dogmatic realism view believes that all material worlds should be objective, and metaphysical realism adds one more claim to dogmatic realism, claiming that things really exist [3]. The quantum mechanics measurement problem casts doubt on both beliefs. What is the reality of quantum mechanics? Or what is the existence of quantum mechanics?

The concept of existence in the micro-world described by quantum mechanics is controversial. Particles in quantum mechanics exhibit both wave-like and particle-like behaviors. This duality means that quantum entities do not exist as definite particles with precise positions and momenta until they are observed. Instead, they are described by wave functions that represent a probability distribution of possible states. Before human measurements, a particle's state is not determined and remains in a superposition state. Only after a measurement is made, the wave function collapses to a specific state, and the particle is found to exist in a particular location or state. Particle's existence as pure probability distribution before measurement raises the question of how to define reality and the matters that existed in it. Are the particles at specific quantum states after measurements real and exist? Or are the probabilistic states of particles also reality? Or the act of measurement itself is the reality? The latter could be understood through Heidegger's perspective.

In the process of measurement, the subject interacts with the object, and both become inseparable from each other. The ultimate quantum mechanical reality can be seen as the act of measurement, where the subject-observer and the quantum system are both present and dependent on each other. This corresponds with Heidegger's intention of eliminating the subject-object division in philosophy traditions.

In addition to this, in Heidegger's philosophy, the center of his discussion is Dasein, the being of humans in the world. He pointed out that Western metaphysics forgets being and the meaning of being and neglects the difference between being and beings. The ontological discussion in

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traditional metaphysics focused on beings instead and attributed being as a property of beings. However, Heidegger advocates for returning to being itself, following a phenomenology tradition, and placing being as the prerequisite instead of the property of the being. He advocates that it is only possible to study being through humans' lens, through Dasein, the only being in the world that can sense and ponder on its own being. Heidegger mentioned in his book Being and Time that "Dasein is its possibility" [2]. As Michael Gelven said, putting probability above reality is an important feature of understanding Heidegger's "Dasein" [4]. Heidegger also emphasizes that Dasein is always planning ahead and is the state of becoming a being. Thus, analogizing with the theory of Dasein, the existence or reality in quantum mechanics can be seen as the probability states of the particles as well as the dynamic process of the particles collapsing from superposition states into one single state, the measurement process. This measurement process, however, is often considered unobservable and cannot be mathematized, which embodies a notion of non-transparency that is unique to quantum physics. In the traditional Copenhagen interpretation of quantum mechanics, the observer and measurement behavior is not strictly defined.

This transparency in quantum mechanics comes from its introduction of the notion of contextuality, where the appearance of the phenomenon cannot be separated from the contextual conditions in which it takes place [5]. In classical physics, there is a self-identical body moving in space and time, and strict causality connects experimental appearances. However, in quantum mechanics, there is no self-identical body, and the notions of space, time, motion, identity, and causality cannot be inherited from classical physics. The phenomenality of the phenomenon in quantum mechanics is determined by the conditions of experience, leading to non-transparency in measurement. This non-transparent nature brings quantum mechanics bizarre phenomena as well as new notions different from classical physics, including retrocausality and superdeterminism. The paper will continue discussing these distinctive notions in quantum mechanics and try to comprehend them with the help of Heidegger's philosophy, which can in turn let us comprehend the distinctive reality in quantum physics.

3. Heidegger's Philosophy of Time and Retrocausality

Before quantum mechanics, most physics followed a vulgar view of time, a uniform, linear and infinite series of "now". The future is coming now, and past is the gone now. In this view, time is a flowing line from the past to now to the future, and the priority is placed on now. Such a view is challenged by later theories and experiments in quantum mechanics. In quantum mechanics, physicists have long disputed over whether locality or local causality, stood up in the microscopic world. British physicist John Bell established his famous Bell test, which involves performing random simultaneous measurements of two entangled particles and checking it with Bell's inequality, to solve the dispute. In May 2023, the researchers at ETH Zurich performed an experiment with the best precision for the Bell test [6]. The result shows that quantum mechanical objects that are far apart can have a much stronger correlation than the conventional system predicts, which disproves Einstein's local causality in the micro world. The non-locality nature of the micro world leads to several promising theories. One is believing that there is a spooky interaction that transcends distance. Other two are retrocausality and superdeterministic. Retrocausality is a theory that believes future events affect past events. In other words, the current state of a particle can be determined by the quantum states of the particle in the past and in the future. It challenges the conventional assumption of causality in time sequence, which means only past events can affect future events. This new relation found in quantum mechanics, the retrocausality, seems counterintuitive but can be interpreted and supported by Heidegger's philosophy.

Heidegger's philosophy is known for its challenge of the vulgar view of time. In his philosophy, there are three states of being: the being that precedes itself, the being that is already in the world,

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the being that is attached to “Seiende", people or things who or which are being. These three states correspond with the past, now, and future in the vulgar view of time and form a unity. He thinks that the future tense of this being is the standard to measure the past and present of Dasein, enabling us to determine the two modes of Being: authenticity and inauthenticity. Inauthenticity is when people embody their fallenness to reality, falling into tasks that other people tell them to do. They live as Das Man, without considering other possibilities of living, and live with dread and anxiety. Authenticity on the other hand means to radically consider the possibilities at our disposal, to understand and embrace our facticity, and to be introspective about our fallenness and to avoid the trap of Das Man and become Dasein. “Dasein” is thrown into the world, whereas it is also determined by the future probabilities it planned. Thus, the past, now, and future in Heidegger’s philosophy are closely related systems that can affect each other. This idea largely corresponds with the idea of retrocausality in quantum mechanics, in which future quantum states of a particle can also affect now and past.

4. Lack of Free Will in Heidegger’s Philosophy and Superdeterminism

The lack of free will is another common theme in the superdeterminism theory of quantum mechanics and Heidegger’s philosophy. Superdeterminism theory is another attempt just like retrocausality to solve the “spooky action at a distance” in quantum entanglement. It is a radical theory that asserts everything in the world is preconceived under the hidden variable, a deterministic law. Not only all the observed phenomena but also the observers themselves in the experiments are controlled by the deterministic law, a theory that violates the statistical independence that “distributions of hidden variables are independent of measurement settings” [7]. This implies that the experimenter is not free to choose the measurement set independently of the value of the hidden variables, a loss of free choice.

In Heidegger’s philosophy, people are thrown into this world, a process one can not control. People are also naturally compelled to behave along the trend and to live inauthentically, living under others’ instructions and following the trends of people and society. The idea of following the crowd, or lack of free will, prevails in Heidegger’s philosophy, resembling superdeterminism.

5. Conclusion

This essay delves into the intersection of Martin Heidegger's philosophy and the realm of quantum mechanics. Through exploration of the philosophical concepts, particularly Heidegger's theory of being and theory of time, the essay draws parallels with the fundamental ideas in quantum theory. Notably, the concept of measurement as the essence of reality is presented, aligning Heidegger's insights with the enigmatic nature of quantum phenomena.

Furthermore, the essay ventures into the depths of quantum mechanics' non-transparency, using Heidegger's philosophy as a lens to interpret the unconventional theories that emerge from this inherent uncertainty. The integration of Heidegger's tripartite framework for states of being adds depth to the discussion, particularly in the context of the retrocausality theory, where the convergence of Heidegger's theory of time and quantum mechanics becomes evident.

Finally, the essay thoughtfully draws parallels between the concept of "Thrownness" in Heidegger's philosophy and the superdeterminism theory of quantum mechanics and emphasizes the lack of free will in both theories. This juxtaposition highlights the potential for Heidegger's philosophy to shed light on the intricacies of quantum physics, offering a novel perspective on understanding this elusive and captivating field.

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This essay paves the way for further exploration and discourse on the integration of Heidegger's philosophical insights into the realm of quantum physics, emphasizing the rich possibilities that arise when two seemingly disparate domains of thought intersect.

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