Quantum mechanical measurement in monistic systems theory

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Abstract

The monistic worldview aims at a uniform description of nature based on scientific models. Quantum physical systems are mutually part of the other quantum physical systems. An aperture distributes the subsystems and the wave front in all possible ways. The system only takes one of the possible paths, as measurements show. Conclusion from Bell's theorem: Before the quantum physical measurement, there is no point-like location in the universe where all the information that explains the measurement is available. Distributed information is possible. Movement of the particle and measuring process are deterministic. The oscillation between location uncertainty and momentum uncertainty leads photons to determine their own location at short intervals. The uncertainty principle focuses the systems. The fields of the surrounding matter influence the location of the new formation. The effect of all fields is based on a common mechanism.

Keywords: quantum mechanics; Bell's inequality; deterministic; uncertainty principle.†

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1. Introduction

Essential questions in quantum physics cannot be solved with the help of the dualistic models used. The relationship between reality, locality and causality is unclear. It is controversial if the measurement process is deterministic and the process is not understood. The monistic systems theory has a different basis and brings new insights. The philosophical problem of the whole and its parts is at the center of the system-theoretical model of quantum mechanics. In this model, the quantum physical measurement process occurs without a logical break.

There is a disagreement in quantum physics. Are the processes in the universe based on determinism or indeterminism? This question should be clarified with the help of Bell's inequality. In the Copenhagen model, it is derived from Bell's inequality that the quantum physical measurement process is indeterministic. In the systems theory model, it is derived that the quantum physical measurement process is deterministic. Following this model, there is therefore no entanglement, no collapse of the wave function and it is possible to design a measurement mechanism.

2. Philosophical and scientific base of the model

Parmenides of Elea formulated the following statement: "*The being is."* (Parmenides 510 - 440 BC). For idealism only the unchangeable, the eternal is *"real"*. Democritus of Abdera tried to unite materialism and idealism in his dualistic atomic theory: *"Unchangeable atoms move in empty space."* (Democritus 460-370 BC). The monistic information theory / systems theory (Bertalanffy, 1950) also combines stability and change: laws are permanent, systems are subject to change. Systems form a unit; their inner properties fluctuate.

Good models cover all aspects, i.e., they are monistic. If two models that do not harmonize with each other are combined, you get a model duality with a logical break between the two models. This is a problem of the wave-particle duality theory of quantum physics. To solve this problem, interpretations inspired by the German idealism and based on the concept of magic were developed. Erwin Schrödinger criticizes this in his cat analogy (Schrödinger, 1935). Albert Einstein, Nathan Rosen and Boris Podolsky tried to solve the problem of quantum physics by defining the term *"real"* (Einstein et al., 1935). This started a wide range of discussions, which led to the development of Bell's theorem (Bell, 1964). It has been experimentally tested and confirmed many times. How is it to be interpreted?

3. Quantum mechanical measurement

3.1 Bell's theorem

The common conclusion from Bell's theorem: *"According to Bell's theorem ... local events cannot be affected by actions in space-like separated regions ..."* (Zeilinger, 2007). There are no *"hidden variables"* (Pawlak, 2022). If there is no information about the measurement result before the measurement, the result is based on objective coincidence. This interpretation is based on the following assumptions: point like emitter, long-range movement, point like collector.

The systems theory assumes the following conditions: extended emitter, long-range movement, extended collector. This leads to the following conclusion from Bell's theorem: Before the quantum physical measurement, there was no point in the universe where all the information that explains the measurement result is available. Distributed information obeying the laws of wave theory is possible. During the movement, information processing takes place. This statement is in harmonie with the wave concept and QED. Here, too, the information is distributed in space. The measuring process can be deterministic, the measured value can be based on deterministic coincidence. Bell's theorem states which calculation method is to be used to describe the processes of quantum mechanics. It is to be calculated with trigonometric functions and not with everyday algebra.

3.2 Fourier Analysis: Uncertainty Principle and Determinism

The mathematical concept of *Fourier analysis* is suitable for analyzing two different problems: uncertainty principle and determinism (Fourier, 1822). Phase differences create deterministic chaos. And the statistical distribution form the basis for interferences. When coherent waves are superimposed, phase differences determine whether they amplify or cancel out. In *QED*, considering all paths has solved the problem of amplification and extinction (Feynman, 1961). The wave function does not have the required partial information (individual oscillations, distribution, paths, obstacles, reflections). This "hidden" part of information is consistent with Bell's inequality. The same results are obtained in the same environments. The results can be changed deterministically, for example by optically active media.

The *Heisenberg uncertainty principle* is linked to the Fourier analysis (Heisenberg, 1930). According to it properties can be limited. This has been experimentally confirmed. Exact values are not possible. Point like objects are abstractions. In the case of quantum mechanical manipulations and measurements, the measured value is limited by Heisenberg's uncertainty principle. The wave function is preserved. The collapse of the wave function is just a construkt of the wave-particle theory. There is no collapse of the wave function and all waves remain in our world.

3.3 Systems theory

Systems only work if all the necessary prerequisites are in place. The Systems theory and a model of quantum mechanics based on it can be falsified.

Systems have the following properties: Systems take in information, process it and pass it on. Systems can divide (beam splitter) and merge (measurement). The subsystems create and maintain the higher systems. Systems create boundaries. Systems obey the principle of separation (separability) with a blurred boundary and interactions with the outside world. Systems have the evolutionary tendency to keep their parts together. In wave theory, this is called self-focusing. Systems are asymmetrically reversible, like the balance wheel in a watch.

3.3.1 The whole and its parts

Systems consist of systems that consist of systems. What are the properties of the lowest level? At this level, the systems are mutually part of the other systems. The relationship between the whole and its parts is determined by dynamics. The system oscillates. Sometimes a system is more of a whole consisting of parts, sometimes more part of other wholes. From a quantum physics perspective, beeing part and whole are complementary properties.

The photo effect is based on the fact that systems always function as a whole when interacting. Each elementary system consists of the existing virtual elementary systems in space, which are constantly forming and disintegrating. The quantum information of each system is dynamically distributed to the other systems. As in the wave theory, the various pieces of quantum information are superimposed without interfering with one another.

In atomic theory, the lowest level consists of immutable atoms. The atomic theory has the same problems as Leibniz's monad theory (Leibniz, 1714); unlike in systems theory, there are no interactions. In systems theory, the applicable laws are always observed at all levels. The higher-level laws arise by restricting the lower-level laws. Restriction can create new properties. For example, the properties of matter through the Pauli exclusion principle. Resonators restrict waves. It is possible that not only molecules but also elementary systems are resonators.

3.3.2 Movement

Systems must always be preserved, even during movement. How does light from a distant star get to Earth without dissolving the photon system? The stability is based on an oscillation between position uncertainty and momentum uncertainty. The uncertainty-wave can be divided into two phases. The electromagnetic field builds up, the momentum uncertainty reaches its minimum and the position uncertainty reaches its maximum. Due to the interactions between space and momentum, the center of the position uncertainty shifts. Now the position uncertainty sinks to its minimum. The self-focusing of the photons is based on the limitation of their properties based on the uncertainty principle. This keeps the Photon system together. It moves through space and transports energy. The wave front is created by the interaction of many self-focusing photons.

3.3.3 Double slit experiment

Systems form a whole made up of subsystems. An aperture distributes the subsystems and the wave front in all possible ways. The system only takes one of the possible paths, as measurements show. If the split wave front meets again behind the aperture, the path information is deleted like with a quantum eraser and interference occurs. In contrast to the de Broglie-Bohm theory (Bohm, 1952), only the wave function determines the further development. The system is consistent with the *corpuscle theory* (Newton, 1704), *wave theory* (Huygens, 1678) and *Bell's inequality* (Bell, 1964).

3.3.4 Matter and movement

The oscillation between position uncertainty and momentum uncertainty continues constantly. Matter is constantly dissolving and reforming. An illustrative explanation makes this clear. Just as human bones are constantly dissolved and re-formed and thus change their shape, so is matter constantly dissolving and re-forming. The electromagnetic and gravitational fields of the surrounding matter influence the location of the new formation. The effect of all fields can be traced back to a common mechanism.

Systems have interactions with the outside world. Influences can be described at different levels. At the level of the wave function there is constructive and destructive superposition. Influences on subsystems create decoherence or resonance and coherence. System have rules, like the Pauli exclusion principle. Different systems have different rules and properties, such as fermions and bosons.

It is postulated that the fundamental processes of physics are always based on a single mechanism. It follows all movements are based on the oscillation between the complementary properties. In quantum physics, objects don't move like billiard balls.

3.3.5 Emission and Immission

During an emission, a system is divided into two different subsystems. In the beam splitter, a system is divided into two mirror-image, coherent subsystems. Every single one of the many partial waves of one ray has a mirrored counterpart in the other ray. The mirror-image properties of both rays are based on mathematical facts. The term ´entanglement´ is inappropriate.

Two systems come together in a measurement. Their wavefunctions resonate and create coherence and superimpose. The unification of two systems into one is a typical system property. Emitter, measuring instrument and collector obey the laws of quantum physics. The measurement of one beam has no influence on the measurement result of the other beam. There are no ´spooky´ effects at a distance.

4. Discussion

The following aspects of quantum physics are particularly highlighted in literature: The measurement problem, the influence of the observer, the meaning of central concepts in contrast to classical physics, entanglement, coherence and decoherence, superposition principle and locality principle, probability interpretation and determinism, the possible existence of hidden variables, relationship to the theory of relativity.

The monistic systems theory respects the standard mathematical formalism of quantum physics. It is a hidden variable theory. Systems can combine and divide. The superposition principle applies. Movement and measurement are deterministic. There is no entanglement. In systems theory, measurements are based on interactions. The type of measurement influences which value of the system is measured. The measured property exists independently of the measurement. The measurement problem that is seen as the main problem in combining quantum physics and relativity theory does not exist.

The Copenhagen interpretation is physically dualistic, the many worlds theory is metaphysical dualistic. These two theories do not explain how a measurement works. The decoherence theory explains the disappearance of interference, but does not solve the measurement problem. In the de Broglie-Bohm theory there are no logical breaks, but their components do not fit together. There are no indications as to how atomic theory and wave theory could be brought together on a common basis. In Bohm mechanics it is theoretically possible to calculate its orbit from the initial state of the particle. This is not possible in the systems theory model. Only probabilities can be calculated here.

The monistic systems theory of quantum mechanics describes the lowest level of our world. What characteristics are evident there? At this level one finds effective laws that interact with one another. These interactions show up in experiments physically and materially. Spirit and matter form a unity. The validity of natural laws and the stability of systems goes hand in hand with the observance of ethical principles. Love (symbioses), justice (natural laws), equality (before the law), freedom (degrees of freedom) and diversity (systems) appears at the lowest level. Ethics, logic and mechanics form the basis of our world.

A comprehensive theoretical and experimental test of the monistic systems theory is required for further evaluation.

5. Conclusions

The monistic worldview aims at a uniform description of nature based on scientific models. Magic and dualistic concepts are open to interpretation only. The model presented here can be falsified with mathematical simulations and also with physical experiments. It uses common methods. It is a model and not an interpretation of the measurement process.

In the monistic systems theory model, quantum physics describes the lowest level. At this level, the systems are mutually part of the other systems. It is a dynamic process in which a system is temporarily more part and more whole. From a quantum physics perspective, beeing part and whole are complementary properties.

Due to the oscillation between the complementary properties, matter is constantly dissolving and reforming. The electromagnetic and gravitational fields of the surrounding matter influence the location of the new formation. The oscillation between location uncertainty and momentum uncertainty as a photon moves in space determine locations at short intervals. An aperture distributes the subsystems and the wave front in all possible ways. The system only takes one of the possible paths. In a measurement two systems come together and their wavefunctions resonate and create coherence and superimpose.

This model leads to the following conclusion from Bell's theorem: Before the quantum physical measurement, there was no point in the universe where all the information that explains the measurement result is available. Quantum physics are deterministic. The processes of quantum mechanics are not influenced by the consciousness of an observer. Schrödinger's cat is either alive or dead and not both at the same time.

Quantum physics respect locality and causality. The reality, however, is different than assumed in idealism. In physics, the unchangeable has no (interaction) effect and is not physically real. The world therefore has more of the properties that Heraclitus postulated: *"Everything flows."* (Heraclitus, 520 - 460 BC).

Main conclusion: Quantum physics are not based on magical or quasi-magical processes.

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