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Quantum Manner of Description
In The Micro world

Valbona Tahiri[1], Astrit Denaj[2*], Jorgo Mandili[3], Fatjon Musli[4]

[1,2,3,4] Physics Department, Faculty of Technical Sciences, University "Ismail Qemali" Vlore, Albania

Abstract

In the classical manner of description, implicitly is accepted the independence of physical processes by the method of observation and the possibility of accurately and completely description of each process. In quantum mechanics such abstractions, are unacceptable. It affirms that the properties of micro-objects are appeared during their interactions with the measurements apparatus, whereas the theoretical predictions are formulated as the expected results of interaction with a certain probability. The set of such interactions leads to the statistical distribution of these probabilities. In the microworld can't be done without intermediaries. As necessity intermediaries are the measurements apparatus. In this article we will present the principal idea, that the adequate manner of description is determined by chosen method of observation. So, instead of the known concept of relativity to the calculation system (the classical manner of description), is introduced the concept of relativity at the observation tools (quantum manner of description), a more general concept than the first.

Keywords: classical manner, quantum mechanics, interaction, observation tools, relativity.

1. Introduction

It was the time when physicists began to think differently, not with the old classical logic, but with a new one, quantum logic, which reflects a new way of thinking: the ability of accepting of new images, although may appeared as paradoxes. After Planck, with difficulty, finally accepted that "the quantum of action" was an idea that would radically change the physical thinking of that time, based on the concept of continuity of all cause-effect relationships of Newton-La Place. This was confirmed only in 1920, when he his Nobel lecture he, said: "Quantum of action plays in physics, an important role at what I thought at first, and as a result of this was fully conscious that that the explanation of atomic problems, are necessary new methods of study. By this hypothesis Planck reached "apogee" in the field of science, and in 1920 awarded Nobel Prize. Planck overthrew a "myth" of classical physics, the myth of continuity, and affirmed a new image; atomism of action which will lead the revision of all concepts and laws of classical physics. The atom-ism of Planck's action would lead to a new way of thinking. According to Landau, "Planck introduced into physics the logic, if we can say in this way. And this he did not willingly, but obliged, because he saw no other way. We say not logical, because his hypothesis contradicts common basic logic of classical physics, where physicists of that time, were not suspicious. In physics was established, an original situation- the existence of opposing arguments: logical and illogical. In this strange situation, was realized a major process of quantum theory, which, by Planck's hypothesis first came up today to quantum physics -ends Llandau (Plank, 1900). Physicists began to learn the way of thinking differently - not anymore, with the old classical logic, but with a new one - quantum logic (Plank, 1900). The old logic allowed only two answers to the question on the position of electrons at a given moment: the electron, or is located at the given point, or is not found in it. Along with "yes" and "no" there is also the "indefinite": we cannot simultaneously determine the position and velocity of particles: The more we try to fix the value of one, the less precisely the other can be known. This great logical difficulty allowed physicists to explain the phenomena of matter and radiation in a new physical way.

2. WHAT IS THE ESSENCE OF THIS NEW WAY OF DESCRIPTION OF THE PHYSICAL PHENOMENA?

The way of description, according to Bohr, is called the fundamental physical theory, which is emerged as a recognition tool of a defined area of physical phenomena. The way of description includes even the description of new effects. The logical tools of obtaining of information about these phenomena, and also the multilateral connections of the system of concepts with experiments etc. We note that the fundamental physical theories are the description ways even in the mean of method, for the most of special theories (for example, quantum mechanics, to quantum electronics) (Rozenberg, 1935). The first fundamental physical theory was Newtonian mechanics. The physical picture of the world, according to it, is accepted absolutely true and essentially the only one. In the classical way of description, it was considered, that the absolute explanation of exact, equivalent, and complete of physical phenomena through existing theories is completely realizable. It was assumed that in this case:

Knowing the initial state of a physical system the evolution of this system at any moment of time can be determined. Mathematically, this axiom expresses the fact that the dynamical variables as functions of time satisfy the system of differential equations of first order.

The accuracy of cinematic and dynamic variables are obtained according to our requirements.

Every physical process is realized on experimental conditions, in the desired direction.

In principle, it is always possible the model of methane, of perception of every physical phenomenon being studied, particularly the cause-effect relationships.

Always we can set the difference between the behaviour of the physical object "itself" and the observation of physical phenomena.

In the study process the object remains unchanged, i.e., it is independent on the condition of recognition ("object itself").

[In principle it is possible the infinite separation of the physical world, in the ensemble of independent objects or elements. As Einstein noted, in classical physics, it is assumed that the external physical world consists of the whole of things (physical elements located in a defined order of the space-time continuum). Every object, located in different areas of space, exists in a specified time interval, despite from the other objects. Consequently, according to Bohr is defined that the researcher has unlimited opportunities to split the phenomenon and to deeply analyse every step of the physical system (Llaue, 1969).

In principle it is assumed that, or, must be neglected the interaction between objects with the measuring devices, or must be calculated the influence of measurements in the studied phenomena.

Finally, in this case we say that in the classical way of description is postulated the separation between subject and object of recognition. In a few words, the above picture can be expressed differently: considering the process that occurs in the physical system, as a substitute of the system states in the time, the classical physics reaches to the state concept absolutism, meanwhile to this concept it gives the meaning of a completed characteristic of the system: for systems having a finite number of degrees of freedom, giving the state, shows the giving of instant values of all measurements entering in the system. The question on the concrete conditions of the measurement of these quantities and the concrete ways to find out a state even for the time required for such a finding to classical physics does not mat-ter. Classical physics takes the complete description of physical processes through characterization of system state by physical quantities corresponding to the degrees of freedom of physical system, setting the change progress of these quantities as a function of time. In this way, the fundamental abstractions that classical physics uses, are reduced to the absolute character of physical processes in the meaning of their independence on the observation conditions and in the possibility of de-scribing them in an accurately and comprehensive way. This situation is differently presented by the emergence of the quantum of action. The existence itself of the quantum of action shows a specific correlation between the localization of an object in time and space and its dynamical state. From the viewpoint of classical physics this connection is completely unexplained and moreover incomprehensible to the consequences that it leads (Plank, 1906). The existence of quantum of action leads to the contra-diction between the concept of the rigorous localization in space and time and the concept of dynamic development. Now, we cannot express anymore on the flow continuity at the microscopic level: the action change of the physical systems, interaction between physical systems occurs only with "quantum jump" with discrete and indivisible portions, i.e. with quanta. For these interactions, some physical quantities with a finite size determining a specified position of micro object are modified by a finite size, and for whatever real conditions, they do not tend to zero; for them there is a limit, which is called the quantum of action. So, the given the object position, its location in the space, cannot be considered outside, and regardless of the influence of external conditions which physically, limit the state of given object. So, even the quantity of motion, as a dynamic parameter, depends on surrounding conditions. It is accepted even by classical physics. But in the latter, are not taken into account the wave properties of real particles. They are considered not as particles but as a wave -group, localized in the space and time. This localization cannot be smaller than Planck’s constant *h*. This fact is reflected in the quantum theory in the form of uncertainty principle of Heisenberg. This relation shows the limits of using of the classical method of description which, as it is above mentioned, is related to some abstractions: the independence of physical processes on the way of observation, the possibility to observe simultaneously. All sides of a given process and the equivalent determination of every process. The existence of quantum of action excludes these abstractions. It does not allow to objectively determining the object state in the classical meaning (Lorentz, 1904). So strange in the first view, this relation is completely consistent with experiment, if we take into account that measurement apparatus are also quantum objects (from their structure) and are subject to the same relation, on the other hand, calculate the excitation influencing on the state of micro objects. This excitation cannot be small as we desire and not completely con-trolled by us. Hence, at the microscopic level, we cannot split with exact limits the object measured by the apparatus. This last introduces an uncontrolled excitation, whose final magnitude is directly related with atomism of action. The existence of the uncontrolled excitement removes the limits of distinction between subject and object and leads to the revision of classical concepts, and the necessity for a new description of physical phenomena. At the base of this description is the interaction between micro object with the measurement apparatus. The necessity of describing atomic objects in this way derived from the fact, that in this area, cannot be worked without mediator and they are apparatus or observation tools. During this interaction are also showed the properties of this object, and the predictions of the theory are formulated as the expected results of interactions (Rosenblum& Kuttner, 2011). They have a defined probability. So, in this new way of description, instead of the familiar concept of relativity to the system of calculating (the classical way of description) put the concept of relativity to the tools observation (quantum way of description), is introduced more general, that the concept of relativity to the system of calculation. Such a question does not exclude the introduction of quantities that characterize the object itself whatever the apparatus is (charge, mass, spin of the particle, etc.) but also allows studying behaviour of object by it (for example, particle or wave-like behaviour), whose appearance is conditioned by the itself construction (for example, the motion of electrons in iconoscope and the beam of electrons in crystalline grid) (Bohr, 1913). This new question presented, allows to consider also the case when different sides and different properties of the object does not appear simultaneously, for example, the ability of electron to localize and its ability to interfere. Bohr proposed that the properties appearing during the mutually exclusive conditions complement each other. The simultaneous appearance of complementary properties does not make sense. By this is explained the absence of internal contradictions in the concept of "wave-particle unity": the micro object is propagated like wave and is detected like a particle, so, depending on experimental conditions it exhibits both wave and the particle properties. This unity wave-particle shows that way of description, is determined by the chosen method of observation. Now, for the micro world, we have a new way of description, different from classical one which is precisely dedicated to the Planck's constant.

3. OPERATIONAL METHOD

The method description of physical processes in the micro world, calculating the relativity against the new question presented on observation tools, in a natural way, requires a mathematical tool, more complicated to the classical physics in which the processes described are isolated in "itself". Now, in the micro world, for given external conditions, the result of interactions between the apparatus and the object is not defined in an equivalent way, but has only a defined probability (Broglie, 1962). The series of such interactions, leads to statistics, corresponding to a defined distribution of probabilities. So, we pass on the generalization of the state concept of the physical system, which is already characterized by the wave function. It is used to express all the probability distributions of the system measurements. New mathematical tool must give the distribution of probabilities for the different quantities, and not simply the numerical values of them. In classical theory, are present the numbers (values of quantities) and in quantum theory are present the functions. If the function y = f (x) has meaning of the relation between the set of numbers x and the set of numbers y it can be also talked for the more general correlation; now no between numbers, but between the functions or as it is said today, operators. The operator is given if it is known the law under which the function f (x) is associated with the other function r (x). Thus, the operators in quantum mechanics allow finding the distributions of probabilities. In this case, it is necessary calculating of instruments, which serves for measurements; this can be done after the group of quantities to be showed to which the apparatus is able to measure. The possible values of measured quantities, continuous and discrete, must also be obtained from the mathematical tool (they are taken as an own values range of respective operators) (Plank, 1906). The problem on the possible values can be formally reduced to a problem on the probabilities: These values can be possible to which the probabilities may be different from zero.

$$r_i - r_f = \beta_i (r_M - r_f), i = 1, 2, ..., n \tag{1}$$

4. Conclusion

Operators are appeared in quantum mechanics for several reasons: Firstly, the characterization of atomic objects properties by the operators shows that the measurement of these properties generally changes the state of the object: as a result of operator action in complete function describing a defined state, it is transformed into another wave function describing another state of the same object. Secondly, the concept of the operator is more appropriate for the collection of information on the possible values of the physical quantities which can be taken as a result of its measurement. It is precisely this measurement that symbolizes the operator. Only own values of operators which symbolize the possible values of physical quantity, from which the measurement "selects" only one. We note that the mathematical tool of quantum mechanics differs from the mathematical tool of classical mechanics, not by the fact that it is symbolic, but from the different object of its study: it operates no with numbers but with the functions, since the numerical expression corresponding to the quantities itself, but their probabilities. In this case, the probability must be calculated for the specified conditions of the experiment, which is characterized no simply by the showing of system, but with a more complex and more comprehensive way: external conditions and measurement apparatus. So, operators are used to express the dynamical variables such as impulse and energy. If every variable is associated with respective operator and these operators are subject to the classical relations between the respective quantities, then we reach to the relations of quantum mechanics. Thus, the transition to the operator concept corresponding to the specifics of quantum relations, and in a recent specific calculation of the laws of micro world. This transition allows to "translate" the quantum relations in the language of classical relations. That is, in a general view, the content of the new way of description of micro-objects, which are not "things in themselves", but always conditioned from external conditions of measurement apparatus.

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