

## Chapter 1

# Introduction: From quantum mechanics to mystery of consciousness

“For the invisible reality, of which we have small pieces of evidence in both quantum physics and the psychology of the unconscious, a symbolic psychophysical unitary language must ultimately be adequate, and this is the far goal which I actually aspire. I am quite confident that the final objective is the same, independent of whether one starts from the psyche (ideas) or from physis (matter). Therefore, I consider the old distinction between materialism and idealism as obsolete.”

Wolfgang Pauli

(From the letter by Pauli to Rosenfeld of April 1, 1952. Letter 1391 in [Meyenn (1996)], p. 593. Translated by Harald Atmanspacher and Hans Primas in [Atmanspacher and Primas (2006)].)

In this chapter we shall briefly enlist the main ideas of the book and their origins. In the following chapters this list of ideas will be filled by the concrete contents, and the logic which makes these ideas convincing will be traced.

Some of the following chapters will be written with the usage of special terminology and mathematical apparatus of quantum physics. They will be marked as intended for readers-physicists and may be skipped without detriment for understanding the main line of consideration.

## 1.1 Questions to be answered

There are questions that cannot be answered (or at least cannot be convincingly answered) in the context of modern science:

- What is consciousness?
- What is unconscious and why is it so important?
- Is it possible to find out truth intuitively, if no information for this is available (super-intuition)?
- Is foresight of the future possible?
- Is it possible to manage reality, i.e. influence the events by the power of the consciousness?
- Can consciousness “create miracles”? Are miracles actually incompatible with natural sciences?
- Can the phenomenon of life be reduced to physical and chemical laws or is there something else in this phenomenon?
- Why living beings are so efficient in surviving?
- How health is supported in an organism and why the most dangerous diseases sometimes disappear without any medicine?
- Is it possible to overcome the global crisis of our technical civilization?
- What is the nature of the great scientific insights?
- Can natural sciences (including quantum physics) be purely objective and ignore subjective elements (consciousness of observers).
- How the work of a scientist should be organized at the moment when a novel view on the problem is necessary for its solution (i.e. how a scientist can initiate the scientific insight)?

These questions will be considered in the present book together with the natural scheme of consideration providing answers to all of them. This system may be called theory of consciousness and unconscious. It will shed light not only on the phenomenon of consciousness (mind), but also the phenomenon of life.

All these questions are from the area of spiritual life of humans or, more generally, concern the mystery of life. It turns out that such questions can be completely or partially answered if the specific understanding of the concept of reality, unavoidable in quantum mechanics, *quantum reality*, is taken into account.

We shall consider quantum reality and theory of consciousness, taking, as a starting point, the so-called *Many-Worlds interpretation of quantum mechanics* suggested in 1957 by Hugh Everett.

Although quantum reality and Everett's interpretation may be presented in all details only for professional physicists, most of the important ideas in this area may be presented in a simpler form available for non-professional people. We shall provide the simplest possible approach to the problem, demonstrating the essence of this approach by examples, metaphors and graphical illustrations. However, in each case we shall give also the strict quantum-mechanical consideration (although in simplest possible formulation).

## 1.2 Two spheres of knowledge

There are two spheres of knowledge (spheres of cognition) which are quite distinct.

- One of these spheres is the natural sciences that deal with the objectively existing material world and its laws. The scientific laws are in essence simple and concern simple (or rather elementary) objects such as elementary particles. Technically complicated calculations arise (when applying the fundamental laws to real situations) as secondary effects caused by a large number of elementary objects and arbitrary initial and boundary conditions. The scientific laws are expressed in terms of the sophisticated mathematical apparatus and are analytic, i.e. are aimed at the reduction of complicated systems to their elementary components.
- Another sphere concerns the sphere of subjective experience of a person, his/her consciousness. This sphere includes knowledge of the rich internal world of a human. The contents of this sphere are expressed in the form of the images and ideas together with their verbal expressions (sometimes long texts) rather than short formulas. Conclusions in this sphere are typically based on synthesis rather than analysis.

These two spheres of knowledge seem to have nothing in common, since their methods, subjects of the investigation and the very nature of their contents are different. Nevertheless, there is a very important connection between them. It exists because each of these spheres turns out to be in a sense incomplete (for example logically unclosed) if the other sphere is excluded from the consideration.

- The deep analysis of the sphere of spiritual life of human reveals such aspects of this sphere that are directly connected with the work of consciousness and arise feeling of something mysterious, not yet understood or even not understandable. These aspects are conveniently called mystical. If they are considered separately from the natural sciences, then the consideration of mystics and of the whole spiritual sphere seems to be naive, out-of-date, taken from the past and having no roots in the present. However, attempts to understand or explain human consciousness and especially its mystical features from the viewpoint of the natural sciences give no convincing results.
- The sphere of natural sciences looks (and actually is) modern, deeply rooted, well-substantiated and reliable. However, the deep analysis of its logical structure clearly demonstrates that the very core of this knowledge which lies in the area of quantum physics contains conceptual problems, or paradoxes. These problems cannot be solved until the second of the two knowledge spheres (spiritual sphere) is explicitly accounted. At least the consciousness of an observer has to be included into the consideration for the description of measurement be complete in quantum mechanics.

We shall consider in this book the approach to unification of these two spheres of knowledge on the basis of the conceptual structure of quantum mechanics. The main issue will be the interpretation of the phenomenon of consciousness in terms characteristic for quantum mechanics. This is not derivation of consciousness from quantum physics. It is rather constructing theory of consciousness starting from the ideas invented for solving the internal conceptual problems of quantum mechanics.

The conceptual problems of quantum mechanics become evident in description of measurements (observations) of quantum systems. The origin of these problems is in the specific concept of reality accepted in quantum mechanics. may be formulated Therefore, quantum theory of measurement and the concept of quantum reality will serve as the starting point for theory of consciousness.

The logical chain leading from quantum mechanics to theory of consciousness begins in the necessity to include the observer's consciousness as a necessary element in theory of quantum measurements. It is important that the expansion of quantum mechanics due to this necessity leads finally not only to solving the internal problems of the quantum mechanics itself,

but also to understanding what is consciousness, thus giving contribution to the spiritual sphere of knowledge.

Due to the specific character of quantum reality, purely objective science turns out to be impossible. The subjective component of our knowledge must be necessarily accounted. The nature of our world may be completely explained only on the basis of the unification objective (natural-scientific) and subjective (mental, or spiritual) spheres of knowledge. The unification of these so different areas should conserve the richness of each of them as well as their relative independence of each other.

### 1.3 Super-intuition: Where do right solutions come from?

Anyone knows about the efficiency of intuition. It provides right solutions of the most complicated problems. It is often supposed that intuition is only the ability to think very rapidly, deriving the conclusions with the help of the usual rational arguments by very quickly, almost instantaneously. However, intuitive solutions are available even in the situation when there is no rational background for such solutions.

We shall use the special term, *super-intuition*, to underline this specific situation when the right solution is found although there was no way to logically derive it from the information available in the usual way.

Super-intuition is in a sense obtaining information that seemingly cannot be obtained. This mystical ability “to make what cannot be made” is nevertheless actually observed. To explain why this is possible will be one of our tasks.

What is the basis for super-intuitive solutions? Where the information for such a solution come from if no information is available by the conventional means? We shall argue that all this is possible due to *direct vision of truth*, the special ability of our consciousness. Quantum mechanics explain why this is possible.

#### 1.3.1 *Super-intuition in life and in science*

You surely know the situation when you have to accept an important decision, but, just because of its vital importance, cannot choose one of several options. The indeterminacy may continue for a long time, often many days, causing painful feeling of helplessness and despair. It is impossible to stop continuous fruitless thinking on the problem that again and again goes in

the same circle of reasoning but gives no result. How to stop this endless thoughts, how to choose one of a number of solutions avoiding fatal mistakes?

The answer is amazingly simple. You should briefly survey your reasoning once more and completely stop thinking on this problem. In order to take mind off the subject, it is helpful to make something pleasant, may be simply go to cinema or theater. The decision will come unexpectedly, accompanied by the delightful feeling that it is the only right one. Future experience confirms that this decision is in fact the best of all possible options.

Here are two bright examples of such situations.

A diver who is going to make a record of the depth of submergence without apparatus experiences great danger at the moment when he/she reaches the maximum depth and turns backward. He/she has to choose the moment of returning in such a way that to achieve as deeply as possible but have enough time to achieve the surface. Returning a little bit later may mean death. How to make right decision in this critical situation? The experienced sportsmen (sportswomen) tell that before this critical moment they sink into a sort of trance and make the choice of the returning moment in the unconscious state.

The other example occurred with Russian cosmonaut Grechko. He experienced the off-nominal situation on his return on the Earth in one of his cosmic trips. The main engine was down and he had to turn on the small subsidiary engine with restricted resource. Then he had to turn it off in the manual mode so that his cosmic apparatus began slowly descend in the regime of free fall. wrong choice of the moment of turning the engine off could lead either to heavy landing or to staying the apparatus on the orbit without chance to land. Grechko had no way to calculate the right time, but he chose it intuitively and avoided both dangers. The choice was made in great emotional tension, and it is most probable that the cosmonaut was in the state of trance.

How and why this happens? Why right solutions of the most important problems are found instantaneously and without any grounds for these solutions? The short answer is that the decision is chosen in these case by intuition. However, the well known word 'intuition' denotes in this case a strange ability of our consciousness, the ability of direct vision of truth. The intuitive solution of the problem happened to be in this case valid just because it has been not a simple guess but the direct vision of truth.

The same phenomenon takes place also in case of “scientific insights” when an unexpected solution of a scientific problem (or a principally new direction of thinking on the problem leading to the solution) is found not by rational reasoning but as a simple guess having no logical ground. Of course, the guess of this type comes only after the scientist was systematically working on the problem by usual rational methods and thus clearly formulated the problem in the scientific terms.

### 1.3.2 *Parallel alternatives (parallel worlds): what does this mean*

Very briefly, consciousness and super-consciousness (usage of super-intuition) may be explained by parallel worlds predicted by quantum mechanics. This is reflected in the title of the present book.

Someone asked me: “Life in parallel worlds... Who lives there - in these parallel worlds?”

Many people write nowadays about “parallel worlds”, meaning various things behind this term, but mostly some modification of oriental beliefs. One psychic talks about four “worlds”, describing in detail how they look, what are their constructions, who lives there and what are these worlds for. He said even how each of the worlds is called. I asked him how can he know about all this, especially about names of the worlds. He answered that one of his pupils (each year he is teaching psychic practice for a group of young people) is regularly traveling along these worlds and tells him about them.

Of course, I mean not this. Logic of quantum mechanics leads to such conclusions that it is difficult to believe in them but it is impossible to ignore them. Among these conclusions, the most important is that the quantum world, with its “quantum reality”, may be adequately presented as the set of many classical worlds, *parallel worlds*. These classical worlds are in fact the various “projections” of a single objectively existing quantum world. These classical worlds differ from each other by some details, but they are pictures of the same quantum world. These parallel classical worlds coexist, and we are parallelly living in all of them (a clone of each of us in each of these classical worlds).

Thus formulated, the concept of many coexisting classical worlds is counter-intuitive. And it is counter-intuitive, but only from the point of view of classical intuition. In quantum mechanics it cannot be otherwise. The reason is that for any given classical state of a quantum system<sup>1</sup> its

<sup>1</sup>More precisely, almost classical. A quantum system cannot be in a purely classical state, but some of its states are close to classical, almost classical.

future state is presented as a number of coexisting (superposed) classical states. At the next step each of these classical states converts into the set of a number of coexisting (superposed) classical states and so on. The result is the enormous number of parallelly existing (superposed) classical states.

This argument is applicable to the whole quantum world which is also (infinite) quantum system. Therefore, typical state of the quantum world is the set of enormous number of parallel classical worlds.

To agree this strange picture (which is in fact confirmed by many experiments) with the everyday experience, physicists suggested that of all possible alternative classical worlds arising with time, a single one is randomly chosen in each moment, so that always only a single world exists. However, this suggestion, convenient as it may be, is in fact incompatible with the strict logics of quantum mechanics. As a result, the *well-known paradoxes of quantum mechanics*.

It is only in 1957 (i.e. three decades after the quantum-mechanical formalism had been created), a young American physicist Hugh Everett III turned out to be bold enough to consider such an interpretation of quantum mechanics according to which no choice of a single worlds is made, so that all parallel worlds do actually coexist.

The interpretation of quantum mechanics that accepts objective coexistence of many distinct classical worlds has been called Everett's, or Many-Worlds interpretation. Not all physicists believe in this interpretation, but the number of its adepts is increasing rapidly.

The Everett's worlds which have to coexist due to the essential nature of quantum mechanics (due to "quantum concept of reality") are the "*parallel worlds*" considered in this book. We see a single world around us, but this is only illusion of our consciousness. Actually all possible variants (alternative states) of this world coexist as Everett's worlds. Our consciousness percepts all of them, but separately from each other: subjective feeling of the perception of one of the alternative worlds excludes any evidence of the others.<sup>2</sup>

### 1.3.3 *Consciousness and quantum mechanics*

The essence of the Extended Everett's Concept (EEC), or Quantum Concept of Consciousness (QCC) suggested by the author and considered in this book is that turning the consciousness off (as in sleep, trance or med-

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<sup>2</sup>One may say that we live in *Alterverse*, the set of parallelly existing alternative classical worlds, or alternative classical realities. This term is an analogue of the term "Multiverse" used in quantum cosmology for the set of many quantum Universes.

itation) exclude separation of the Everett's worlds from each other. Then all of them together are available for what is left instead of consciousness and what can be called *super-cognition* because it supplies the information that is not available in the usual (conscious) state. Turning consciousness to the process of super-cognition and backward to consciousness can be called *super-consciousness*.

The super-consciousness provides the access to all variants of evolution of the world we see around us (alternative scenarios of the world) and can find out what of them is advantageous. This gives the unique information unavailable by the usual perception organs and explains the phenomenon of super-intuition, or "direct vision of truth". In more common situations (when consciousness is turned on but some processes in the organism are regulated in unconscious regime) this explains the mechanism of surviving (support of health), i.e. the very phenomenon of life.

One more natural suggestion is that super-consciousness may not only obtain information from the whole set of Everett's worlds but influence the probability of each of them to be subjectively felt in future. This gives a mechanism for influence on "*subjective reality*" and may explain "*probabilistic miracles*", i.e. seeming violation of scientific laws. Actually no laws are violated in this case, but the probabilistic (stochastic) nature of quantum-mechanical laws is exploited.

All this may look complicated at the first glance, but is in fact very simple and natural in the context of quantum mechanics in its Everett's "Many-Worlds" interpretation (which in turn is the only logically closed interpretation). The whole EEC (or QCC) includes, in comparison with the original Everett's interpretation, only two additional assumptions. One of them explains the phenomenon of surviving ("miracle of life") and super-intuition (direct vision of truth). The other explains "probabilistic miracles", i.e. the ability to arbitrarily choose the subjective reality by consciousness and super-consciousness.

This book is devoted to the mentioned abilities of our consciousness and many other relevant phenomena. Some of them are known as mystic events, some are similar to miracles (the special type of miracles, connected with the consciousness and unconscious).

The phenomena of this type are investigated by various spiritual traditions including various religions, oriental philosophies, esoteric doctrines, parapsychology etc. However, we shall consider them from the scientific point of view.

At the first glance, the phenomena of this type contradict to modern natural science and are impossible from the scientific viewpoint. This however is not valid if such mysterious branch of science as quantum mechanics is taken into consideration. Moreover, it turns out that quantum mechanics is logically incomplete and needs theory of consciousness to be included in it for becoming logically closed. The quantum concept of reality is such that the resulting theory of consciousness (and unconscious as an essential element) predicts quite unusual abilities of consciousness, among them direct vision of truth and “probabilistic miracles”.

The thought that quantum mechanics and consciousness are closely connected has been stated by many authors, beginning from Wolfgang Pauli in collaboration with Carl Jung and up to Roger Penrose. During the long history of quantum mechanics important new aspects of the connection between quantum mechanics and consciousness were analyzed and the efficient mathematical instruments for this were developed. It is now almost evident that the so-called Many-Worlds interpretation of quantum mechanics (Everett’s interpretation) should play the key role in the final theory connecting consciousness with quantum mechanics.

The ideas of Pauli concerning this issue were not widely known until the end of 20th century, because Pauli never published them, discussing this topic only in letters to his friends. Now his short thoughts on this subject arise great interest and are often cited and discussed (see for example [Atmanspacher and Primas (2006); Enz (2009)]).

The Extended Everett’s Concept (EEC) proposed by the present author in 2000 connects the issues of consciousness and quantum mechanics by a very short chain of reasoning. This makes the resulting theory quite plausible. In this book we shall present and develop this scope of ideas, trying to do this in the simplest possible way.

**Remark 1.1.** The following two remarks have to be added about the usage of the term “consciousness”.

- This term, as it is used in literature, is not quite unambiguous. By conscious one may mean various psychic phenomena. Everywhere in this book we understand this term in the sense originating from the quantum-mechanical term “consciousness of an observer”. This sense of the word may be defined as the most deep and at the same time most primitive aspect of the phenomenon, the “root of consciousness”. This is what differs the state “I aware that I perceive something” from the state when nothing is perceived and the

person is not aware of anything. Contrary to this, the word “consciousness” is often understood as denoting intellectual processes developing on the background of consciousness (for examples calculations or rational thinking).<sup>3</sup>

- The state of unconscious plays the key role in all phenomena discussed in this book (including the phenomenon of the super-intuition mentioned above). In fact, the most important for these phenomena is the interrelation between the states of consciousness and unconsciousness. Therefore in many cases, talking about the whole scope of the discussed phenomena and saying for example “the role of consciousness” we shall mean the role of the states of conscious and unconscious and transitions between these states.

#### 1.4 Principle of life is not derived from but is added to science

This book is about the phenomena of consciousness and life and their explanation on the basis of quantum mechanics. The task to explain these phenomena is very old, and the task to explain them with the help of quantum mechanics is very popular nowadays. Yet the approach taken in this book radically differs from what other authors suggested.

Usually the scientists, in their attempts to explain consciousness and life, tried to derive the phenomena of life and consciousness from the laws of motion of matter. In other words, they tried to reduce these phenomena to the laws found by such sciences as chemistry and physics. This direction of research may be called *reductionism*. Despite of many interesting achievements on this way, this approach never gave positive results in the main goal of reductionism: in reducing the laws of living matter to the laws found in the investigation of the inanimated matter.

New hopes to obtain such an explanation was connected with the new ideas of quantum mechanics, such as quantum information and quantum computers. Usually the hypothesis is considered that some structures in brain work as a quantum computer. However, no significant results were achieved in this direction too. Quantum version of reductionism does not work too, although the hopes connected with it do yet exist.

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<sup>3</sup>We shall almost never make use of the word “consciousness” in this sense. The exclusion is the task mentioned in Sect. 9.1 to change consciousness from egotistic to altruistic.

The approach suggested by the author in 2000 and exposed in the present book is different. According to this approach, the phenomena of life and consciousness cannot be mechanistically reduced to the action of the laws of science as they are found in the course of exploring the inanimated matter. The explanation of these phenomena on the basis of quantum mechanics requires addition of a special independent element to the set of quantum concepts and laws.

Such a new element of theory should directly connect quantum concepts with the concepts characteristic of life. The simplest way to find this element is to consider the phenomenon of consciousness and compare it with the description of observation (measurement) in quantum mechanics. Then it may be formulated as identification of consciousness with the “separation of the alternatives” — a concept relating to the “Many-Worlds” interpretation of quantum mechanics. It is interesting that the addition of this element simplifies the conceptual structure of quantum mechanics instead of doing it more complicated.

If we consider not only the phenomenon of consciousness but more general phenomenon of life, this additional element may be called “*life principle*”. It very naturally follows from the analysis of theory of consciousness, but in fact it acts for all forms of life, even simplest forms having no consciousness. The life principle formulates evolution of living system in such a way that it is determined by the goals as well as by causes. The main goal of the living system is survival so that their evolution provides their survival. However, for more sophisticated forms of life, the goals may include other criteria of the quality of life.

The phenomena of life and consciousness therefore cannot be reduced other to quantum mechanics or to any other theory of inanimated matter. Of course, the laws of these sciences act in the processes performing in the bodies of living organisms, but life and consciousness are not the direct consequence of these processes. Life is not the function of a body, and consciousness is not a function of the brain. Rather body is a realization of life, and brain is an instrument of consciousness.

Life and consciousness are something additional to the natural sciences, even additional to quantum mechanics. Yet the main features of life and consciousness (including the most deep, mystical features of them) are naturally connected with the specific feature of quantum mechanics called “quantum reality”. This is why life and consciousness can be understood on the basis of quantum mechanics. In order to guess what are the main points of theory of life and consciousness, one can start from quantum

mechanics and analyze the most deep, counter-intuitive features of quantum mechanics, those which make this branch of science strange and not quite transparent.

The idea of the additional assumption that should be accepted to go over from quantum mechanics to theory of consciousness is hinted by the conceptual structure of quantum mechanics itself. This is the approach applied by the present author to find the explanation of consciousness and life. The secret of this approach that gave very interesting results is very simple: one has to analyze the conceptual structure of quantum mechanics, first of all its conceptual problems (paradoxes) forgetting all the dogmas, explicitly or implicitly existing in science. Then, on the way to the most simple formulation of the structure of quantum mechanics, the additional assumption is suggested, that simultaneously 1) simplifies the conceptual structure of quantum mechanics and 2) explains the phenomenon of consciousness.

The simplicity of the resulting logical construction and important consequences following from it give the impression that the correct way is found. The results may then be analyzed from various points of view including philosophical ones.

### 1.5 Graphic presentation of the relation between the two spheres

Carl Jung compared the relation between the sphere of psychic and the material world with the two cones having a single common point coinciding with the vertex of each of them (Fig. 1.1).

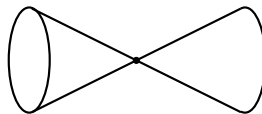


Fig. 1.1 Two spheres of knowledge have common point, special for each of them.

We shall show later that the common point (or rather the common area of the two spheres of knowledge) is nothing else than the concept of consciousness as well as the circle of concepts and phenomena related to consciousness. It is important that all the concepts and phenomena in this common area are not, up to now, well understood in the framework of natural sciences. We shall argue that the interpretation of them as belonging to both spheres provides their explanation.

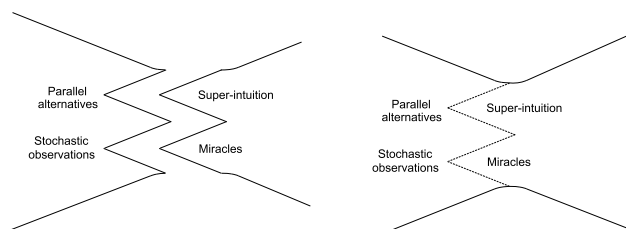


Fig. 1.2 Left picture: Quantum mechanics (left) has defects, or paradoxes; spiritual knowledge (right) includes mystical features. Right picture: if both spheres of knowledge are joined, the paradoxes of quantum mechanics explain the mystical features of spiritual knowledge.

This may be symbolically presented in Fig 1.2. This figure takes into account two paradoxical features of quantum mechanics: *parallel alternatives* (paradoxical because alternatives cannot parallelly coexist in classical physics) and *stochastic nature of the results of observations* (paradoxical because in classical physics an ideal observation with a given initial state is unambiguously determined, its results cannot be stochastic). The figure expresses symbolically that these two paradoxical features in quantum mechanics provide the explanation of the corresponding mystical features experienced in the psychic practice: *super-intuition* (direct vision of truth) and *probabilistic miracles*. This will be discussed in detail later in the book.

Thus, the connection of the two spheres of knowledge is performed in the area corresponding to the special (paradoxical) concepts in the natural sciences and special (mystical) phenomena in the spiritual knowledge. The special area of the natural sciences is connected with quantum paradoxes (quantum reality). The special area of the spiritual knowledge is mystics and miracles related to psychic (consciousness).

It is natural that the configuration presented symbolically in Fig. 1.2 provides more clear understanding of the concepts of both spheres of knowledge than it is possible without their confronting. The theory unifying both material (natural-scientific) and spiritual (mental, psychic) knowledge will better explain what is “consciousness” (mind, psychic).<sup>4</sup>

<sup>4</sup>The approach based upon quantum mechanics will show that mystical features of consciousness appear when permanent or temporary transition to the regime of unconscious occur. Therefore, the term “phenomenon of consciousness” includes in fact the interrelation of conscious and unconscious states of “mind”. Talking of “nature of consciousness”, we often mean the nature of the phenomena reflected somehow in our consciousness but actually depending on both conscious and unconscious states.

## 1.6 Toward theory of consciousness

It may seem strange but consciousness, the phenomenon which is well known to each one, is not understood by modern science. If consciousness is a product of brain, then theory of consciousness should be elaborated in the framework of neurophysiology. And actually physiologists sometimes claim that they understand what is consciousness. However, despite of radical improvement of the technology applied in the research, physiology cannot explain the nature of consciousness as such (of course, good progress is made in the investigation of the intellectual processes being realized on the background of consciousness as such).

The lack of success in the explanation of consciousness shows that the nature of consciousness cannot be understood in the limits of chemical, physical or information processes realized in the brain. This is indirectly confirmed by strange phenomena observed in consciousness and phenomenologically denoted as mystical. It is almost evident that mystical features of consciousness hardly could be explained as a result of physical and chemical processes in brain.

However, while consciousness cannot be understood in the context of chemistry, classical physics and physiology, it turns out that it (or at least its main features) can be understood in the context of the quantum mechanics. More precisely, the essence of consciousness can be interpreted as a special type of perception of *quantum reality* by living beings.

### 1.6.1 *Mystical features of consciousness are compatible with quantum mechanics*

*Mysticism* and mystical features of consciousness were treated long before emergence of the modern science, in various types of pre-scientific knowledge. However, nowadays the scientific explanation of any phenomenon is expected. If something is observed but not explained by natural sciences, it is usually considered as not confirmed. Therefore, the question of relation between mystical features of consciousness and natural sciences is actual.

Mysticism includes miracles, and this seems to exclude its scientific explanation. Indeed, a *miracle* simply by definition is something that is cannot exist in reality. In a more precise formulation, a miracle is something that, according to the laws of natural sciences, cannot occur. Is not it evident that this exclude mystical phenomena from the scope of those existing in reality? Strangely enough, but this “evident” conclusion is

incorrect. The phenomena looking as mystical can be observed, and this does not contradict science.

The explanation of this paradoxical statement is in *probabilistic nature of quantum-mechanical laws*.

If reality were described by classical physics, mystical phenomena could not exist in reality. However, after great scientific revolution of the first quarter of 20th century we know that *reality is correctly described only by quantum physics*, and only approximately it can be presented by classical equations. Precise laws of nature are quantum, and one of the cardinal difference of quantum laws is their probabilistic, or stochastic, nature.

This feature of quantum laws is revealed when quantum system undergoes measurement. Even if the state of the system before a measurement is precisely known, the result (readout) of the measurement cannot be unambiguously predicted. It is possible to enumerate the alternative measurement results and predict probability of each of them. Such a probabilistic law can be verified only by a long (ideally infinite) series of measurements. Those alternative measurement results which are more probable should happen more often, less probable measurement results should occur rarely.

But this means that *a single measurement can neither confirm nor refute any probabilistic law*. Let one of the possible measurement results has very low probability, say  $10^{-9}$ . Almost all people, including professional physicists, will consider observing this result “practically impossible”. According to this, observing this result of measurement in reality “practically contradicts” to the given law, so that this observation would be a miracle.

However, considering the situation in the mathematically strict way, we can only predict that in an extremely long series of measurements (many millions of events) the given result will be observed on the average in one event from each million of events. However, it cannot be predicted in what concrete measurements this result will be observed. It may be observed even in the very first measurement of the series, and this would not contradict to the probabilistic law. Moreover, this measurement result, although having very low probability, may well occur if the measurement is performed only once. This happening, strange as it may look, would not contradict the probabilistic law.

The final conclusion is in fact astonishing: *a single event may look as a miracle, without any contradiction with a probabilistic quantum-mechanical law*. Quantum mechanics allows strange events that can be called *probabilistic miracles*.

Thus, the phenomena that look as miracles (i.e. mystical phenomena) are compatible with the modern natural sciences, because quantum mechanics is the heart of these sciences and probabilistic miracles are allowed by it. This principal possibility is realized in Quantum Concept of Consciousness (QCC), the theory of consciousness, following from quantum mechanics. We shall discuss it briefly in the next sections and in more detail in the subsequent chapters.

### 1.6.2 *Quantum mechanics is incomplete without consciousness*

We are going to explain consciousness, including its mysterious features, on the basis of modern science, because they badly need a sort of scientific explanation. It turns out however that science also needs inclusion consciousness in its structure. The reason is that *quantum mechanics is logically incomplete without inclusion the concept of consciousness*. Quantum physicists do not often aware of this because the mathematical structure of quantum mechanics, including the probabilistic laws, is quite correct. This provides correctness of all calculations and solution of all practically arising problems. However, when deeply analyzed, quantum mechanics is met with *conceptual problems (paradoxes)* that cannot be solved without inclusion of subjective element, for example the concept of consciousness.

The conceptual problems of quantum mechanics are revealed in description of measurements (observations) of quantum systems (shortly, in *quantum measurements*). They may be also illustrated in a transparent form as paradoxes.

#### 1.6.2.1 *Paradox of Schrödinger's cat*

To illustrate paradoxical character of quantum mechanics (existing conceptual problems in it), one of the creators of this branch of science, Erwin Schrödinger, suggested the following thought experiment. In fact this paradox illustrates the difference of the concept of reality in quantum mechanics from the reality as it is meant in classical physics and in our usual intuition.

Take a black box and put into it a cat together with an unstable (gradually decaying) atom and an automatic device destroying an ampule with poison if the atom is decayed. Then at the beginning of the experiment the atom is not decayed and the cat is alive. If at some moment the atom is decayed, then the cat is dead. These two cases are clear and do not differ from what can exist according to classical physics. However, the atom, as

a microscopic object, obeys quantum mechanics, and this implies unusual conclusions.

According to quantum mechanics, any state of any quantum system is a vector. This means that, just as in case of the usual vectors, the states of the quantum system may be summed up.<sup>5</sup> The result of summing two or several state vectors are called in quantum mechanics *superposition*.

The state of the atom at the initial moment is “non-decayed”, but with time it becomes the superposition (non-decayed atom + decayed atom), with the first term of this sum gradually decreasing and the second increasing.<sup>6</sup>

Let us recall now that the state of the cat is directly connected with the state of the atom. We have to conclude then that the state of the system atom+cat is (non-decayed atom and alive cat + decayed atom and dead cat), see Fig. 1.3.

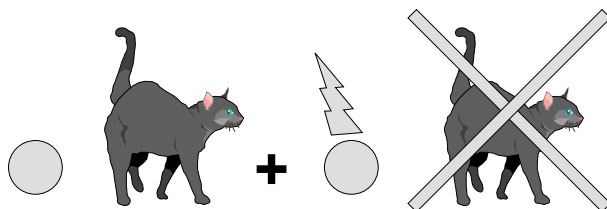


Fig. 1.3 Schrödinger's cat in quantum superposition. “Quantum reality” suggests co-existing the parallel worlds (alternative classical realities) such that the cat is alive in one of the worlds and it is dead in another world.

Now what shall we see if opening the black box at this moment? Can we see the cat in the state describing as a superposition of the alive cat and the dead cat? Evidently not. We shall alternatively see either the alive cat (and yet non-decayed atom) or the dead cat (and already decayed atom).

This is the paradox. Describing the state in the closed box according to quantum mechanics we have to present this state as the superposition. But for the open box the description, in accordance with our experience, should be one of the component of this superposition.

We see that in this reasoning, leading to a paradox, *essential role is played by our consciousness*. Until the box is open, the information about

<sup>5</sup>They may be also multiplied by (complex) numbers, but this is not important for us at the moment.

<sup>6</sup>This means that the first (correspondingly second) term is multiplied by the increasing (correspondingly decreasing) coefficient.

the state of the system did not yet enter into our consciousness, after opening the box we are conscious of this state.

The main conclusion from the paradox of Schrödinger's cat (that is in fact a simplified model of a more general situation of a quantum measurement) is necessity (in the context of quantum mechanics) of superpositions even for macroscopic systems, such as a cat (or measuring device). This requires *serious revision of the concept of reality, which finally lead to the theory of consciousness.*

#### 1.6.2.2 *Quantum reality*

Let us say a few words about a *quantum measurements*, situation that generalizes the situation of Schrödinger's cat.

The main conclusion from the consideration of quantum measurements is following. In quantum mechanics superpositions of states may exist (when states are summed up as usual vectors). This is proved by enormous number of experiments with microscopic objects. However, consideration of quantum measurements shows that superpositions of states of macroscopic systems should also exist.

A superposition may include (as its components) *macroscopically distinct states*, such as alive and dead cat or the state of the measuring device with the pointer directing to the left and another state with the pointer directing to the right. Such superpositions cannot be identified with anything emerging in practice of observers (a cat either alive or dead, but not both, the pointer directs to the right or to the left, but not both). This is one of the characteristic features of what is called *quantum reality*. The seemingly contradiction of this from the observations needs a special explanation. Such an explanation is given in the Many-World interpretation of quantum mechanics suggested in 1957 by Hugh Everett. The following steps lead from the Everett's interpretation of quantum mechanics to the "quantum theory of consciousness".

#### 1.6.2.3 *Many-Worlds interpretation of quantum mechanics includes consciousness*

Thus, logically we have to conclude that not only microscopic objects, but also macroscopic objects are also quantum and therefore may be in the states of superpositions. Moreover, the components of the superposition may be macroscopically distinct: alive and dead cat in the Schrödinger's

cat paradox, the pointer of the measuring device directing to the right and to the left as a result of a quantum measurement.

This contradicts to our everyday experience (but more precisely—to the experience of our consciousness). This is the reason why this straightforward conceptual conclusion of the basics of quantum mechanics was not accepted for decades after completion of its mathematical formalism. However, in 1957 the bold enough physicist made this simple step: Hugh Everett III proposed his famous *Many-Worlds interpretation of quantum mechanics*.

According to this interpretation, any states of our (quantum) world may coexist as the components of superposition. These coexisting states may be macroscopically distinct. We are used to think, on the ground of the experience of our consciousness, that coexisting of macroscopically distinct states of the world is impossible. However, this proves possible because quantum mechanics requires this, and quantum mechanics is very well verified.

To make the situation more transparent or better compatible with our common-sense concept of reality, the physicists suggested another terminology: not the different states of the quantum world coexist, but different classical worlds coexist as the components of the superposition. The only objectively existing quantum world is a superposition of different classical worlds, often called *Everett's worlds*. Thus, in the situation of Schrödinger's cat paradox the objectively existing quantum world is a superposition of the two classical Everett's worlds. In one of these Everett's world the cat is alive, in the other Everett's world the cat is dead.

We shall accept another terminology that may be less transparent but much more convenient for the analysis. We shall say that (in the above example) the objectively existing quantum world is *objectively* in the state of the superposition of two states (the alive and dead cats coexist, usually alternative to each other), but our consciousness perceives the components of this superposition separately from each other, or *the consciousness separates the alternatives*. This means that an observer may see the alive cat, but then he/she does not see the dead cat, and vice versa. Both alternatives objectively coexist, but separated in consciousness (subjectively).

### 1.6.3 Theory of consciousness from quantum mechanics

Everett's interpretation of quantum mechanics allowed to overcome the conceptual problems (paradoxical nature) of this science. However, much more important is that this interpretation allows to do the next step. This

interpretation allows to understand what is consciousness and explain its strange, unbelievable, but nevertheless practically observed mystical features.

As has already been said, it is necessary (for compatibility with our everyday experience) to assume that the alternatives (Everett's worlds) are separated in consciousness. The present author proposed to do one more step and identify consciousness with separation of alternatives. The resulting theory was called *Extended Everett's Concept* (EEC). It may be also called *Quantum Concept of Consciousness* (QCC). This concept explains the nature of consciousness (not explained otherwise) in terms of quantum mechanics.

If the first step (identifying consciousness with the separation of alternatives) is done, an important next step may naturally be done: we can conclude something about *unconscious* (which is known to be very important for human psychic). Indeed, if conscious is the separation of the alternatives, then turning consciousness off is the disappearance of the separation. Therefore, in the state of unconscious the alternatives (all Everett's worlds) are somehow accessible all together, without any separation between them. Remark that they are not perceived in the usual sense of the word (because the usual images are impossible in the unconscious regime), but yet somehow reflected.

It is important that the information about all these (parallel worlds) is available so that they can be compared with each other and the most favorable of all these alternatives can be found. The information about what alternative is the best (favorable) is the basis for *super-intuition*, or direct vision of truth. This wonderful phenomenon that seems to be observed in practice finds thus its explanation in the special features of quantum mechanics.

Another assumption that seems natural in the context of QCC, or EEC, is that consciousness can modify "*subjective probabilities*" of various alternatives. Then those alternatives (Everett's worlds) that are favorable may be made subjectively more probable even if their objective probabilities are very small. The resulting phenomenon may look as a miracle, as the managing reality. However, this is subjective reality rather than objective one. The phenomenon may be called *probabilistic miracle* and turns out to be quite compatible with the probabilistic laws of quantum mechanics.

This line of consideration, leading finally to the main points of the unified theory of matter and spirit, will be followed in detail in the rest of this book. We shall try to present the material parallelly on the two

different levels: first, in a simple form, available for any reader, second, for professional physicists, in a more sophisticated and more professional form, with more details and more areas of research included. The chapters or sections including the complicated material will be indicated as being intended for physicists.