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THE ONTOLOGY OF QUANTUM THEORY

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Abstract

An interpretation of the quantum theory is proposed, allowing an explanation of the origins of the theory principles and its mathematical formalism. In contrast to the hitherto interpretations it is based on the ontology assuming existence of omniscience. The interpretation proposed explains – in consistence with the relativity theory – the results of the correlation experiments implying that an unobserved elementary particle does not exist objectively (beyond our consciousness) or that a quantum system makes o non-divisive unity bound through non-spacetime interactions. According to this interpretation, both these possibilities occur simultaneously.

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1 Motivation

Quantum theory is a wonderful elegant theory, which, at least in principle, allows us to calculate the properties of all physical systems. It gives correct results for the probabilities of paricular results of an enormous range of experiments. It is accurate and universal, and no violations of its predictions are known. The quantum theory is composed of four main elements: *i*) the principles describing general features of the space of states and operators acting in this space, *ii*) the physical interpretation of the elements of the space of states and their relations to observables, *iii*) the specification of the space of states and its evolution for a given physical system and *iv*) the reduction of the superposition of states by a measurement.

Despite much effort of three generations of physicists working on improvements of this theory, no way has been found to change the first and the second elements of the quantum theory without a major logical inconsistency. Therefore, it can be expected that these two elements will remain exactly correct elements of all future physical theories. At present it is assumed that the quantum theory is consistent with the special theory of relativity and for intermediate energies it beomes the relativistic quantum field theory. Special examples of such theories are: quantum electrodynamics, quantum chromodynamics, standard model of elementary particles or GUT theories. The quantum theory consistent with special and general theory of relativity may in future assume the form of a supersymmetric theory in an 11-dimensional space of non-commutative geometry [1] (the so-called M-theory) or a version of the superstring theory in a 10-dimensional space, or the F-theory in a 12-dimensional space – we cannot tell it now. Specific quantum theories satisfying the demands of the general theory of relativity are these used in quantum cosmology [2,3]. These theories treat the relativistic models of the universe as close quantum systems or excited states of a certain quantum superfield.

All these quantum theories have two features in common: they differ only in the third element of the quantum theory and are consistent with the Einstein's theory in the first three elements of the quantum theory, while the fourth element – the process of actualisation at the moment of measurement is clearly contradictory to the spirit of the theory of relativity. It also seems that there is no objective description of actualisation in the spacetime at the moment of measurement, consistent with the demands of the theory of relativity. It should be emphasised that the effects following from specific realisations of the relativistic quantum theory are not in contradiction to the theory of relativity.

The quantum theory equations describing the evolution of states are linear, while the process of actualisation at the moment of measurement is strongly nonlinear and cannot be described by linear equations. The quantum theory does not explain when and why a jumpwise realisation takes place. For instance, the relative character of the concept of the present in the theory of relativity implies that it is impossible to determine e.g. in EPR experiments, which of the two realisations is a cause and which an effect. Moreover, the quantum theory does not explain why people cannot observe a linear superposition of states.

In this paper an attempt is made at explaining the genesis of the first, second and fourth elements of the quantum theory in full consistence with the demands of the theory of relativity. The approach accepted in this work is based on a simple formalism following form the assumed ontology. Although many interpretations of the quantum theory have been proposed [4-7], they do not exhaust all possibilities. The hitherto proposed interpretations have been based on either materialistic or dualistic ontology, and no attempt has been made to propose such an interpretation on the basis of the new ontology assuming existence of omniscience.

2 Omniscience

The beginnings of European philosophy date back to about 2600 years ago, when a small group of Greeks made the first attempt at understanding the world with no reference to religious concepts. To them, the universe appeared as a huge living organism. When confronted with an organism, it is a natural intellectual impulse to decompose it into the simplest elements. To understand the organism, one needs to find its fundamental components and principal laws of its operation. European philosophy started from a well formulated question about the underlying principle of the world. Soon to describe the most fundamental matter and the most fundamental principle of the world, philosophers coined a term *arkhe*. Although the present understanding of the universe is drastically different from that developed 2600 years ago, the problem of finding its *arkhe* is still somewhat important. This problem has had a great impact on the development of the study of the physical world by reducing it to elementary principles, which is still followed today.

It is difficult to say precisely when the word *arkhe* emerged as a technical term of philosophy. It was surely used in this sense by Anaximander of Miletus, a student and then a successor of Thales. Anaximander represents the Ionian philosophy of nature concerned with the search for the first principles and original cause responsible for the form of reality. After Aristotle, the philosophers representing this current were called physicists. Their main aim, i.e. the search for the fundamental principle of reality, which was assumed to be a substantial and normative origin of the universe, has remained one of the most important pursuits of European philosophy partly accepted by modern physics. In contemporary physics this pursuit is expressed by an effort to come up with a general theory making possible the description of all physical phenomena. However, the methodology of physics seems much too restrictive and narrow to allow finding the fundamental principle of reality, that is the *arkhe*.

In the present essay we will show that the true most fundamental principle, being the deepest possible one, is an appropriately define omniscience. Thus, the starting point of our considerations will be the following postulate.

Postulate
There exists omniscience – absolute knowledge that is the greatest possible to be conceivled.

With the above hypothesis assumed to be true, we will consider the consequences of this assumption.

To man, only partial knowledge is available. Having incomplete knowledge by extrapolation, absolutisation and idealisation and by the use of analogies, man can imagine the notion of omniscience. Omniscience is knowledge reaching beyond human imagination and comprehension, understood as everything that a human mind can contain. Since knowledge is an attribute of the mind, we put forward a hypotesis that there exists an intelligent being having omniscience denoted as $\mathcal{O}$ and defined as the greatest possibly conceivable knowledge. So defined, $\mathcal{O}$ is unattainable by human mind and man is only able to determine some of its features implied by its definition.

Let us concentrate on the following important problem: according to the definition of omniscience $\mathcal{O}$ – the omniscient being – knows everything. His knowledge includes full knowledge of himself, which as absolute is identical to its being. Hence, the intelligent being does not have omniscience but is omniscience. Therefore, henceforth we will not talk about the omniscient being but about omniscience $\mathcal{O}$.

For people – intelligent beings of limited knowledge – the knowledge of themselves is much smaller than that fully defining them. My knowledge is not me – if it were me, I would always have it for the simple reason of my existence and I would not have to learn to acquire it; moreover, I would never forget anything. Still, since my knowledge is not me, it is much smaller than me and I do not have full knowledge of myself but only a vague concept of myself as a human being.

Identification of the omniscient being with omniscience can seem paradoxical but it is directly implied by the definition of omniscience. Consquently, omniscience becomes a subject and not a object, not a thing but a being. In this way we reveal the nature of the intelligent and omniscient being which turns out to be omniscience. Concluding what was discussed above we can say that

Conclusion 1

The omniscient intelligent being is the omniscience $\mathcal{O}$, which means that $\mathcal{O}$ is not an object but a subject.

For people the process of acquiring knowledge includes many changes: learning what we have not known, forgetting what we have known, association of facts, meditation or contemplation. The changes result from our ignorance and from imperfection of our memory. We perceive them as a one-directional flow of time overlapping with the relatively regular rhythm of our physiology and changes in surrounding nature. The omniscience $\mathcal{O}$ knows everything possible and does not forget anything; it knows the past, the present and the future and that is why it does not undergo any changes. Its cognitive activity is invariant and unlimited. The omniscience $\mathcal{O}$ has absolute konwledge in a single act of acquiring it in eternity which is not time. Eternity is the plenitude of omniscience being omniscient. Hence:

Conclusion 2

The omniscience $\mathcal{O}$ is invariable and thus eternal.

Undoubtedly there is only one omniscience $\mathcal{O}$, but the omniscience of itself is also omniscience $\mathcal{O}$. As follows from logic, no rational idea includes itself; therefore, there is no rational reasoning allowing comprehension of the omniscience. It also means that it is impossible to comprehend the omniscience for everyone except the omniscience itself. Thus, for us the omniscience is the deepest and incomprehensible secret of incomprehensible sense. Postulating the existence of the omniscience $\mathcal{O}$, we accept the mystery which is the condition of the understanding of omniscience. Therefore, we can formulate:

Conclusion 3

The omniscience $\mathcal{O}$ is and will be an incomprehensible mystery for rational reasoning.

As we know very well from our daily experience, things comprehensible by our senses differ from those created in our minds – imagined – as elements ot our knowledge. It can be supposed that the same is true in the omniscience. Let us assume that along with the omniscience $\mathcal{O}$ there is another real being, which is not the omniscience $\mathcal{O}$; then the omniscience $\mathcal{O}$ includes the knowledge of itself and the knowledge of this real being. However, the knowledge of the omniscience about itself is by definition omniscience, so the knowledge of the omniscience $\mathcal{O}$ would be smaller than omniscience, which would lead to a contradiction. In view of the above we have:

Conclusion 4

Apart from the omniscience $\mathcal{O}$ there is nothing else.

This conclusion implies very strong limitations on the ontological structure of the reality.

The knowledge of omniscience about itself is absolute so it is also the omnicience $\mathcal{O}$ or omniscience $\mathcal{O}'$ identical with omniscience $\mathcal{O}$ but differing from the latter by the fact that $\mathcal{O}$ is the source of $\mathcal{O}'$. It can be said that the omniscience $\mathcal{O}'$ comes from the omniscience $\mathcal{O}$ like my thoughts come from my mind.

As follows from the definition of omniscience as the knowledge possibly greatest to conceive, the knowledge of the omniscience about itself is not the omniscience $\mathcal{O}$ because the existence of omniscience $\mathcal{O}'$ derived from $\mathcal{O}$ enriches the omniscience. Hence, the omniscience is not the only the subject $\mathcal{O}$ but two subjects $\mathcal{O}$ and $\mathcal{O}'$ and the knowledge of the mutual relation between them. The thinker and his knowledge about himself are different so the omniscience $\mathcal{O}$ and $\mathcal{O}'$

differ. The thinker is not the knowledge and the knowledge is not the thinker. The thinker's knowledge originates from the thinker and cannot separate from him and have independent existence. Analogously, $\mathcal{O}$ and $\mathcal{O}'$ are two subjects, but they are not separate. The nature of the two omnisciences is the same because there is only one essence of omniscience.

At this point a complication appears. The knowledge of the omniscience $\mathcal{O}'$ about itself can be expressed in the omniscience $\mathcal{O}$, or $\mathcal{O}'$ or another $\mathcal{O}''$, and so on, the knowledge of $\mathcal{O}''$ about itself can be expressed in $\mathcal{O}$, $\mathcal{O}'$, $\mathcal{O}''$ or $\mathcal{O}'''$. Therefore, according to the definition of omniscience as the deepest and greatest ever possible to imagine, it should be expressed by the infinite and inseparable chain of subjects: $\mathcal{O}$, $\mathcal{O}'$, $\mathcal{O}''$, $\mathcal{O}'''$,...

This is, however, impossible for the following reason. The omniscience, being absolute knowledge, also comprises the acts of will of the omniscience. If there are two subjects $\mathcal{O}$ and $\mathcal{O}'$, the acts of will of the omniscience include their interrelation. Thus, the knowledge of $\mathcal{O}$ about itself should include $\mathcal{O}'$ and the knowledge about the mutual relations between $\mathcal{O}$ and $\mathcal{O}'$, but this would imply that the omniscience $\mathcal{O}$ is greater than the omniscience $\mathcal{O}'$, which is contradictory to the definition of omniscience. Moreover, as follows from the definition of omniscience, the knowledge about the act of will of $\mathcal{O}$ concerning the relation between $\mathcal{O}$ and $\mathcal{O}'$ is identical to the konwledge on the act of will of $\mathcal{O}'$ concerning the relation between $\mathcal{O}'$ and $\mathcal{O}$. Otherwise $\mathcal{O}$ and $\mathcal{O}'$ would differ not only in origin, which would contradict the conclusion that there is only omniscience expressed in the form of a continuous chain of subjects. Therefore, the knowledge of the mutual relation between $\mathcal{O}$ and $\mathcal{O}'$ enhances the omniscience of these two subjects in the same degree.

According to the definition of omniscience (see Postulate), this enhancement is the greatest possible, and it is possible only when the knowledge on the mutual relation between $\mathcal{O}$ and $\mathcal{O}'$ is expressed in the third omniscience $\mathcal{O}''$ derrived from $\mathcal{O}'$ and through it from $\mathcal{O}$.

The presence of $\mathcal{O}''$ generates two new relations: between $\mathcal{O}$ and $\mathcal{O}''$ and between $\mathcal{O}'$ and $\mathcal{O}''$, and the knowledge of them should be expressed in another – the fourth omniscience $\mathcal{O}'''$, expressing also the knowledge of $\mathcal{O}''$ about itself. Hence, the knowledge about the mutual relations between $\mathcal{O}$ and $\mathcal{O}''$ cannot expressed in the omniscience. So, we arrive at the contradiction of the definition of the omniscience. In order to avoid it, we have to assume that the fourth omniscience $\mathcal{O}'''$ is identical with the first one $\mathcal{O}$. It is rather easy to see that this method is the only one to avoid contradiction. Under this assumption, the knowledge of the mutual relations between $\mathcal{O}$ and $\mathcal{O}'$ is expressed in the third omniscience $\mathcal{O}''$, the knowledge of the relations between $\mathcal{O}'$ and $\mathcal{O}''$ is expressed in $\mathcal{O}$, and the knowledge of the relations between $\mathcal{O}''$ and $\mathcal{O}$ is expressed in $\mathcal{O}'$. In this way we obtain a closed, noncontradictory and complete set of relations, with $\mathcal{O}$ expressing its knowledge of itself in $\mathcal{O}'$, $\mathcal{O}'$ in $\mathcal{O}''$, and $\mathcal{O}''$ in $\mathcal{O}$.

Three subjects $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ have the same nature, they are omnisciences, but each one of them is fully itself, aware of itself as itself – the first $\mathcal{O}$ as such, the second $\mathcal{O}'$ as such and the third $\mathcal{O}''$ as such as well.

In their mutual relations $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ are three subjects and persons existing in the relations of *I*, *you* and *we*. They form as inseparable triune. In this triune each of the subjects – $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ – expresses the knowledge of another subject about itself, and the knowledge of the mutual relations of the other two subjects. In this way, omniscience comprises not only the knowledge of the subjects $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$, but also that of their mutual relations. The above considerations lead to the following important conclusion

Conclusion 5

The triune omniscience is an inseparable unity of the three subjects: $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$, differing by mutual relations. The omniscience $\mathcal{O}$ does not come from anything else, the omniscience $\mathcal{O}'$ comes from $\mathcal{O}$ and the omniscience $\mathcal{O}''$ comes from $\mathcal{O}$ and $\mathcal{O}'$. The omniscience $\mathcal{O}$ expresses the knowledge of $\mathcal{O}''$ of itself and the knowledge of the mutual relations between $\mathcal{O}'$ and $\mathcal{O}''$. The omniscience $\mathcal{O}'$ expresses the knowledge of $\mathcal{O}$ of itself and the knowledge of mutual relations between $\mathcal{O}$ and $\mathcal{O}''$. The omniscience $\mathcal{O}''$ expresses the knowledge of $\mathcal{O}'$ of itself and the knowledge of the mutual relations between $\mathcal{O}$ and $\mathcal{O}'$.

A question arises, however. What its the nature of these mutual relations? We can learn about it only by analogy to human relations, since – according to Conclusion 3 – omniscience is not available through rational thinking. We know that relations between human beings are very complex, influenced by a whole gamut of knowledge, feelings and emotions. As a consequence, they cannot be defined precisely, accurately and comprehensively, yet a precise definition is not of importance now. What matters are only dual or bi-subjectal relations, because only such relations can occur in the triune omniscience. Apart from that, human relations can be classified also with reference to existence: I can either be neutral to the existence of another being. I may not desire his/her existence, or I may want the being to exist, which means that I enjoy his/her being. Henceforth, between two persons there can be either the relation of neutrality, or hatred or friendship.

On the basis of the definition of omniscience as the greatest knowledge possibly conceivable, we have to denounce the possibility that the triune omniscience can comprise the relations of neutrality and the more the destructive relations of hatred of the type *I do not wish you existed* With the two options ruled out, only the third type of relation is left – that of friendship. From the same definition of omniscience we can infer that the triune omniscience comprises relations that achieve the highest degree of friendship which is referred to as love.

Love is an unclear, ambiguous and open term that is difficult to define. For our purpose here love is considered only in its ideal sense because it refers to the ideal reality of omniscience. A given subject, which is the omniscience, loves two other subjects, yet each of these relations of love is a relation between two subjects. The loving subject desires the existence of another subject, and it desires it both for itself and for the other subject. What is more, it desires the relation not only for its own and the other subject's *I*, but for *us*. In this *us* the two omnisciences are born as concrete persons and objects of love. The subject $\mathcal{O}$, $\mathcal{O}'$ or $\mathcal{O}''$is a person in relation to another subject, not in relation to itself. We can talk about love only when there are two *Is* and the knowledge about a mutual *we* being the fruit of their unity. In other words, love in an ideal sense is a full unity which at the same time does not cease to be two persons.

Since by its very definition omniscience is invariable, the minimum love relation in a triune omniscience implies an unchanging, mutual and voluntary desire for the existence of another subject to create a unity with it. This suggests that the nature of the relationship in a triune omniscience – which according to a definition of omniscience is love that is the greatest conceivable – is the absolute love. A mutual love between $\mathcal{O}$ and $\mathcal{O}'$, their mutual *we* which is the fruit of their love, is expressed by the omniscience $\mathcal{O}''$ coming from the omniscience $\mathcal{O}'$ and through it from $\mathcal{O}$. Certainly, it is not only $\mathcal{O}$ and $\mathcal{O}'$ that love each other, but also $\mathcal{O}'$ and $\mathcal{O}''$; a manifestation of their love relationship is $\mathcal{O}$. Likewise, the love between $\mathcal{O}$ and $\mathcal{O}''$ is expressed through the omniscience $\mathcal{O}'$. Moreover, as it was already mentioned, $\mathcal{O}$ derives the knowledge about itself from the omniscience $\mathcal{O}'$, $\mathcal{O}'$ from $\mathcal{O}''$, and $\mathcal{O}''$ from $\mathcal{O}$.

Hence, a full symmetry has been achieved in the chain of omniscience: $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$. In love relationship the subjects $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ exist as *I*, *you*, and as an expression of a mutual *we*. In other words, they exist as *the loving*, *the loved*, and *love*. Hence each of the $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ subjects is a fully absolute love. This implies that there can be neither more nor fewer than three loving persons: $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$, which differ in their origin. The omniscience O does not come from anybody, the omniscience $\mathcal{O}'$ comes from $\mathcal{O}$, while the omniscience $\mathcal{O}''$ comes from $\mathcal{O}$ and $\mathcal{O}'$. The subjects constitute an inseparable triune of an absolute love with one omniscience which is love having one will. In the mutual relations of love $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ are subjects of love and they exist as persons.

Therefore, one omniscience is not something, but *somebody* – it is a person, but at the same time a triune absolute love. In view of the above we can formulate:

Conclusion 6

The triune omniscience is a triune absolute love that is possibly the gtreatest conceivable.

It should be noted that the absolute love comprises a unique timeless *dynamic* generated by an infinite chain of three persons mutually permeating one another: $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ because the knowledge of itself of $\mathcal{O}$ is expressed by $\mathcal{O}'$, of $\mathcal{O}'$ by $\mathcal{O}''$ and $\mathcal{O}''$ by $\mathcal{O}$ and again of $\mathcal{O}$ by $\mathcal{O}'$, of $\mathcal{O}'$ by $\mathcal{O}''$ ad infinitum. We can write it down symbolically in the form of an unlimited sequence: $\mathcal{O}\mathcal{O}'\mathcal{O}''\mathcal{O}\mathcal{O}'\mathcal{O}''\mathcal{O}\mathcal{O}'\mathcal{O}''...$, illustrating the dynamic of omniscience. This dynamic functions in spite of an absolute invariability of omniscience and it involves infinite permeation of persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$, where the person $\mathcal{O}'$ exists in the person $\mathcal{O}$ in the same way as my thought exists in my mind, but also – through $\mathcal{O}''$ – the person $\mathcal{O}$ exists in person $\mathcal{O}'$. Analogous

relations hold between all the three persons: $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ – each of them *contains* the remaining two, yet it itself is also *contained* in them. In view of the above we can formulate the following conclusion:
Conclusion 7
Omniscience is invariable, but in the triune omniscience an unlimited and timeless process of mutual permeation of persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ takes place.

At the same time, it is the dynamic of eternal, unlimited and infinite love which is both generated and manifested by persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$. There is a good reason for such a dynamic and unlimited chain of absolute love, since each of the three persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ wants the other two to exist – which is the minimum of love. The triune love is self-generating and it constitutes a closed, imperative and integrated set of explications which does not require any further explications. Then it is the fundamental principle of reality – *arkhe*. This leads us to another conclusion:
Conclusion 8
The triune omniscience is a self-sustaining necessary (non-accidental) being which cannot be non-existent.

Love as a triune omniscience presents an eternal novelty to itself. Its being is an eternal circulation of love, which is not egoism since it is love in which none of the three persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ keeps anything for oneself and this is the love of omniscience which is the greatest possibly conceivable. As it is known, egoism is the attitude of a person who wants to do good for oneself at the expense of another person, while this is out of the question in the case of absolute love which is the greatest possibly conceivable. The existence and life of the triune omniscience is loving. Omniscience is love in itself. The essence of this love is selfless and unlimited giving out of one's inexhaustible fullness.

Conclusions 4 and 6 inform us that the fundament of reality – of everything that exists – is an inseparable unity of persons constituting absolute love. Some people believe that the essence of being is matter or spirit, while others point at oneness. Yet they are all mistaken. The essence of being is the community of love. Absolutely the first is the inseparable unity in love of persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$. The communion of these persons is the archetype of all reality, according to which everything should be moulded. In this communion $\mathcal{O}$, $\mathcal{O}'$

and $\mathcal{O}''$ are all the more persons that they are the only ones, who are all the more a unity that they are persons. Therefore it is absolutely wrong to juxtapose the gift of oneself and fulfilment of oneself.

As follows from Conclusion 4 and 6, everything that exists is omniscience or part of omniscience. This implies that the substance of reality is knowledge which does not exist outside omniscience. According to Conclusion 1, the omniscience is not an object but a subject. One omniscience exists in three persons which differ in their origin. So each of these persons is the omniscience which is at the same time the source and expression of love. Omniscience is invariable but – according to Conclusion 7 – in the triune omniscience an unlimited and timeless process of mutual permeation of persons $\mathcal{O}$, $\mathcal{O}'$ and $\mathcal{O}''$ takes place. Between the three persons a specific dynamic of love is generated, of love that is the greatest possibly conceived, and this dynamic generates a closed chain of absolute love which cannot grow.

Our human existence proves that the triune omniscience in the eternal decree of its will has found a way to enhance the dynamic of love. It took fancy to create from a part of omniscience subjects of limited knowledge, able to love.

As humans we are aware of the fact that we exist as active, self-conscious and intelligent beings of limited knowledge. According to Conclusion 4, we exist as subjects which are components of omniscience. Our conscious human being implies that the non-accidental triune omniscience which is absolute love wants people to exist so that it can create with each of them an independent relation of love. By definition love must be voluntary; therefore, omniscience, out of its free will thanks to which and in which we exist, provided people with a domain of freedom known as the universe which enables them to take unconfined, but somehow limited action. In compliance with the *logic* of love this domain of freedom has to leave them unrestrained in their declaration whether to accept or reject the triune love.

For this to happen, subjects must necessarily have their own free will, since the relation of love between subjects may be established only under the condition of free choice. This naturally presupposes the possibility of choice for or against establishing a relation of love with the triune omniscience. And this is why omniscience created a domain of knowledge in which people can make such a choice. Absolute love must be deeply embedded then not to disturb the sovereignty of human decisions in favour or against establishing the relation of love with absolute love. As humans, we experience such domains of knowledge as our bodies and the surrounding world. The universe cannot be chaotic; it has to be subject to some laws, as for example the laws of physics so that at least in some areas we could make free decisions and take some definite actions. In principle, therefore, everything we observe in our universe should be explicable in a *natural* way – through the operation of specific laws of nature.

Absolute love has hidden itself from us; it not only created the universe but also assigned to each human subject of limited knowledge a defnite knowledge experienced by us as human body. The body determines the basic domain of human freedom. It must be complex enough to consider it – as a complicated data processor – a subject which is a being conscious of its existence. My body is both for me and for others a manifestation of my *I*. It also works as a transmitter of knowledge flowing – through the senses – from the universe to my *I* and of knowledge transmitted from my *I*, from my mind, to the universe.

Since human bodies are extremely complex systems, the environment in which people live on Earth must also be, for obvious reasons, very complex. Consequently, the human world must be a macroscopic world consisting of a great number of interacting elements.

Obviously, these elements (see Conclusion 4) are only *portions* of knowledge stimulated in the human mind by omniscience in compliance with the rules and laws established by it and correlated with a transfer of knowledge to other human minds. This ordered sequence of *portions* of knowledge transmitted by omniscience is perceived by man as the surrounding universe to be experienced by the body equipped with senses. Each subject has *its own universe* generated in its mind by omniscience. Since different subjects receive adequately correlated portions of knowledge, they think that they live in one common universe. This implies that people do not live in the universe but that the universe exists in the minds of human subjects. Then, human subjects with limited knowledge exist in the triune omniscience which is absolute love. Hence one can distinguish three levels of reality. The first and the deepest level comprises triune omniscience which is love. The second level includes subjects with a limited knowledge, existing in the omniscience. The third level is made of ordered sequences of portions of knowledge stimulated, in compliance with the rules established by omniscience, in the minds of subjects and experienced by the subjects as the universe surrounding their bodies.

The laws of nature apply only to the rules of transfer of knowledge to subjects created by omniscience; they do not apply, however, to omniscience itself and to the subjects. This is the reason why we are not able to comprehend the nature of omniscience and subjects using mathematical and empirical methods applied by sciences. This implies that none, even perfect and the most sophisticated, study of the brain will ever reveal the essence of our mind. The structure of our brain, and by the same token, the structure of the universe, is rational for it was designed by the triune omniscience. Hence, the rationality of the universe and its existence come from the same source. The existence of the universe is a manifestation of a rational idea conceived by omniscience. The universe is cognisable also for the same reason for which it exists. If there is no omniscience which is absolute love, then there is no justification for the existence of man, the universe and its rationality, which is a source of philosophy and science. It is only in a rational and meaningful universe that that it is worth pursuing scientific research. This leads us to the following conclusion:

Conclusion 9
Omniscience creates human subjects who have limited knowledge and are a portion of omniscience and who are endowed with a free will. To prepare the highest possible number of such subjects who are voluntarily willing to establish with it the relationship of love, omniscience provides their minds with ordered and correlated knowledge which is experienced as their bodies residing in a common and rational universe.

On this base let's take the following assumption:
i) There is a set of human consciousnesses (minds). As human consciousness is a nonphysical concept and it is hard to give its precise definition, although everyone of us has their own clear intuitive understanding of what it means to be conscious. Consciousness is at least a realisation of its own existence. It is useful to introduce a symbolic description of consciousness in the form $\mathcal{C}_n$, where $n = 1, 2, ...$

number consiousnesses of particular conscious beings.
ii) There is the omniscience $\mathcal{O}$ showing the properties analogous to those of human consciousness which transmits the information between individual $\mathcal{C}_n$ according to the scheme

$$\mathcal{C}_n \longleftrightarrow \mathcal{O} \longleftrightarrow \mathcal{C}_{n'},$$

where $n \neq n' = 1, 2, ...,$ and arrows represent the information transmission.
iii) All consciousnesses from the set $\mathcal{C}_n$ believe that they are in the same universe since they receive froom $\mathcal{O}$ mutually correlated information.
iv) The physical laws apply only to the rules of the information transmission between $\mathcal{C}_n$ and $\mathcal{O}$ but they do not apply to the nature of $\mathcal{C}_n$ and $\mathcal{O}$. Thus, the nature of consciousnesses and the way of the transmission of information (ideas) is not cognisable by the method of physics.
v) The universe is not build of the interacting matter but of sequences of information (ideas) transmitted by $\mathcal{O}$ to $\mathcal{C}_n$.

Thus, the universe is immaterial (nonmaterial). Apart from the observations the universe does not contain anything else. The universe is only a dynamic, correlated and ordered sequence of ideas of the consiousness $\mathcal{O}$ communicated to the set of individual consciousnesses $\mathcal{C}_n$. The image of the universe in this ontology is simple but extremely difficult to accept because of its immaterial character.

3 A mathematical model of decision making

The elementary manifestation of will of the consciousness $\mathcal{O}$ is the act of choice. We are not able to know the mechanism of decision making by $\mathcal{O}$. We can only give a phenomenological model of such a process and only a model referring to the physical aspect of the reality, which we can describe with numbers. Let's assume that we have an isolated physical system described by a physical quantity (observable) assuming only two values a_1 or a_2. Prior to a measurement the omniscience $\mathcal{O}$ can choose between two possibilities m_1 corresponding to the observable value a_1 and m_2 corresponding to the value a_2. So before a decision making by $\mathcal{O}$, the state m of a given isolated system is a set of two possibilities $\{m_1, m_2\}$, which can be written as:

$$m = \{m_1, m_2\}. \tag{1}$$

Let's assume that a measurement gave the value a_1. In the model proposed it means that $\mathcal{O}$ in the act of decision making chose the possibility m_1, which can be written as:

$$m = \{m_1, m_2\} \to m_1. \tag{2}$$

At the moment of choosing the set of the two possibilities $\{m_1, m_2\}$ was instantly reduced to one possibility of m_1. The state changed from m to m_1, which is represented by an arrow.

If the state of the physical system considered was described only by the observable a, $\mathcal{O}$ would not have a choice, however, we assume that the possibility of making a choice is its inherent property. That is why we assume that the state of the system is described not only by the observable a, but also a certain observable b. For the sake of simplicity we assume that this observable can also take only two values b_1 and b_2. Therefore, the state m_1 can be expressed as a set of possibilities m_1' (corresponding to b_1) and m_2' (corresponding to b_2). Let's assume that b_2 is a result of measurement of the observable b. Under our assumptions, expression (2) becomes:

$$m = \{m_1, m_2\} \to m_1 = \{m_1', m_2'\} \to m_2'. \tag{3}$$

To simplify the expression let's assume that the state of a given physical system is fully determined by the values of the two observables a and b. In order for $\mathcal{O}$ to have a continuous possibility of choosing the state of the system, we have to assume that the possibility m_2' is a set of possibilities $\{m_1, m_2\}$. Hence, expression (3) becomes an unlimited chain of measurements:

$$\begin{aligned} m &= \{m_1, m_2\} \to m_1 = \{m_1', m_2'\} \to m_2' = \\ &= \{m_1, m_2\} \to m_2 = \{m_1', m_2'\} \to m_1' = \ldots, \end{aligned} \tag{4}$$

describing the history of the system.

A result of a given measurement cannot be predicted by physicists (observers) $\mathcal{C}_n$, however, after a large number of measurements some regularities can be noted, which allow a determination of probabilities p of the subsequent realisations:

$$\begin{aligned} &p(m_1 \to m_1'),\, p(m_1' \to m_1),\\ &p(m_1 \to m_2'),\, p(m_1' \to m_2),\\ &p(m_2 \to m_1'),\, p(m_2' \to m_1),\\ &p(m_2 \to m_2'),\, p(m_2' \to m_2). \end{aligned} \tag{5}$$

The probabilities have to be non-negative numbers satisfying the normalisation condition

$$\begin{aligned} p(m_1 \to m_1') + p(m_1 \to m_2') &= 1,\\ p(m_2 \to m_1') + p(m_2 \to m_2') &= 1,\\ p(m_1' \to m_1) + p(m_1' \to m_2) &= 1,\\ p(m_2' \to m_1) + p(m_2' \to m_2) &= 1. \end{aligned} \tag{6}$$

Because of the above regularities, the probabilities are functions of the possibilities taking numerical values (functionals):

$$\begin{aligned} p(m_1 \to m_1') &= p[m_1, m_1'],\\ p(m_1 \to m_2') &= p[m_1, m_2'],\\ p(m_2 \to m_1') &= p[m_2, m_1'],\\ p(m_2 \to m_2') &= p[m_2, m_2'],\\ p(m_1' \to m_1) &= p[m_1', m_1],\\ p(m_1' \to m_2) &= p[m_1', m_2],\\ p(m_2' \to m_1) &= p[m_2', m_1],\\ p(m_2' \to m_2) &= p[m_2', m_2]. \end{aligned} \tag{7}$$

The main aim of our considerations is finding the functionals enabling the calculation of the probabilities (5).

The sets of probabilities $\{m_1,\, m_2\}$ and $\{m_1',\, m_2'\}$ are mutually exclusive. The question is how to describe this fact mathematically. In mathematics mutually exclusive situations are modelled by introduction of geometrical objects satisfying the conditions of orthogonality, which means e.g. that an object cannot move simultaneously in the exactly vertical and exactly horizontal directions. This condition, known as the condition of orthogonality, is defined by the so-called scalar product. A scalar product of two possibilities m_1 and m_2 is denoted by a symbol $m_1 \cdot m_2$. We assume that scalar products of the mutually exclusive possibilities are zero (they are orthogonal) and the scalar product of the same possibilities is 1.

Unfortunately, such a definition of the product of possibilities is insufficient for a full description of the process of decision making by $\mathcal{O}$, concerning the physical reality (see Appendix). Besides the symbol of the possibility m, we have to introduce the dual possibility defined as

$$(zm)^* = z^* \bar{m}, \tag{8}$$

where z is a complex number and the asterisk (*) stands for conjugation in the sense of complex numbers. The generalised scalar product of possibilities is denoted as $\bar{m} \cdot m$, and assumed to meet the following relations:

$$\begin{aligned} \bar{m} \cdot m \geq 0, \quad \bar{m} \cdot m' = (\bar{m}' \cdot m)^*, \\ \bar{m} \cdot (z_1 m' + z_2 m'') = z_1(\bar{m} \cdot m') + z_2(\bar{m} \cdot m''), \\ \overline{(z_1 m' + z_2 m'')} \cdot m = z_1^*(\bar{m}' \cdot m) + z_2^*(\bar{m}'' \cdot m), \end{aligned} \tag{9}$$

for any possibilities m, m' and m'', and any two complex numbers z_1 and z_2.

Under these assumptions, the condition of mutual exclusion of m_1 and m_2, and m'_1 and m'_2 can be written as:

$$\begin{aligned} \bar{m}_j \cdot m_{j'} = \bar{m}_{j'} \cdot m_j = \delta_{j,j'} = \begin{cases} 1 & \text{for} \quad j = j' \\ 0 & \text{for} \quad j \neq j' \end{cases} \\ \bar{m}'_j \cdot m'_{j'} = \bar{m}'_{j'} \cdot m'_j = \delta_{j,j'} \quad (j,\, j' = 1, 2). \end{aligned} \tag{10}$$

Each of the possibilities occurring in (5) can be presented as a set of two other possibilities.

$$\begin{aligned} m'_1 = f_1(m_1, m_2),\ \bar{m}'_1 = f_1^*(\bar{m}_1, \bar{m}_2), \\ m'_2 = f_2(m_1, m_2),\ \bar{m}'_2 = f_2^*(\bar{m}_1, \bar{m}_2), \\ m_1 = g_1(m'_1, m'_2),\ \bar{m}_1 = g_1^*(\bar{m}'_1, \bar{m}'_2), \\ m_2 = g_2(m'_1, m'_2),\ \bar{m}_2 = g_2^*(\bar{m}'_1, \bar{m}'_2), \end{aligned} \tag{11}$$

where f_1, f_2, g_1 and g_2 are analytical complex functions of two variables being the appropriate possibilities. Having expanded the functions in a power series, we get:

$$\begin{aligned} m'_j &= A_j + B_j m_1 + C_j m_2 + D_j m_1^2 + E_j m_2^2 + F_j m_1 m_2 + \ldots, \\ \bar{m}'_j &= A_j^* + B_j^* \bar{m}_1 + C_j^* \bar{m}_2 + D_j^* \bar{m}_1^2 + E_j^* \bar{m}_2^2 + F_j^* \bar{m}_1 \bar{m}_2 + \ldots, \end{aligned} \tag{12}$$

where ($j = 1, 2$) and A_j, B_j, $\ldots$ are certain complex coefficients following from the series expansion of the functions.

¿From one of the conditions (10):

$$\bar{m}'_j \cdot m'_j = 1, \tag{13}$$

having substituted the series (12), we have

$$A_j = D_j = E_j = F_j = \ldots = 0, \tag{14}$$

$$B_j^* B_j + C_j^* C_j = 1. \tag{15}$$

Subjecting the other functions determining the possibilities m_1 and m_2 (11), we arrive at:

$$\begin{aligned} m'_j &= B_j m_1 + C_j m_2, \\ \bar{m}'_j &= B_j^* \bar{m}_1 + C_j^* \bar{m}_2, \\ m_j &= B_{2+j} m'_1 + C_{2+j} m'_2, \\ \bar{m}_j &= B_{2+j}^* \bar{m}' + C_{2+j}^* \bar{m}'_2 \quad (j = 1, 2). \end{aligned} \tag{16}$$

So, each of the possibilities is expressed as a linear complex superposition of two mutually excluding possibilities. It is a very important result obtained under exceptionally simple assumptions concerning geometrical objects describing the possibilities from which $\mathcal{O}$ can choose.

After scalar multiplication of the first of equations (16) by $\bar{m}_1$ and taking into regard eq. (10) we have:

$$\bar{m}_1 \cdot m'_j = B_j(\bar{m}_1 \cdot m_1) + C_j(\bar{m}_1 \cdot m_2) = B_j. \tag{17}$$

Scalar multiplication of the other equations (16) by the other appropriate possibilities gives:

$$\begin{aligned} m'_j &= (\bar{m}_1 \cdot m'_j) m_1 + (\bar{m}_2 \cdot m'_j) m_2, \\ m_j &= (\bar{m}'_1 \cdot m_j) m'_1 + (\bar{m}'_2 \cdot m_j) m'_2. \end{aligned} \tag{18}$$

and the expressions coupled with them. Then, using the formulas (15) and (18) we get:

$$|\bar{m}_1 \cdot m'_j|^2 + |\bar{m}_2 \cdot m'_j|^2 = 1,$$
$$|\bar{m}'_1 \cdot m_j|^2 + |\bar{m}'_2 \cdot m_j|^2 = 1, \tag{19}$$

where $j = 1, 2$.

The parameters occurring in eq. (19) meet condition (6) and are non-negative, so meet all conditions of probabilities, hence they can be treated as probabilities (7):

$$p(m_j \to m'_{j'}) = |\bar{m}_j \cdot m'_{j'}|^2,$$
$$p(m'_j \to m_{j'}) = |\bar{m}'_j \cdot m_{j'}|^2, \tag{20}$$

where $j, j' = 1, 2$. Eq. (20) are therefore the functionals representing the corresponding probabilities, we wanted to find.

Equations (18) can be rewritten as:

$$m'_j = (m_1(\bar{m}_1 \cdot) + m_2(\bar{m}_2 \cdot))\, m'_j,$$
$$m_j = (m'_1(\bar{m}'_1 \cdot) + m'_2(\bar{m}'_2 \cdot))\, m_j, \tag{21}$$

which implies:

$$\sum_{j=1}^{2} m_j(\bar{m}_j \cdot) = 1,$$
$$\sum_{j=1}^{2} m'_j(\bar{m}'_j \cdot) = 1. \tag{22}$$

Equations (22) are the so-called completeness conditions of the expansions (18).

The expected value of the observable a in the state described by the possibility m'_1 is given by the expression known from the calculus of probability

$$\bar{a}_{m'_1} = p(m'_1 \to m_1)a_1 + p(m'_1 \to m_2)a_2, \tag{23}$$

which, having taken into regard eqs. (20) and (22), becomes

$$\begin{aligned}\bar{a}_{m'_j} &= (\bar{m}'_1 \cdot m_1)(\bar{m}_1 \cdot m'_1)a_1 + (\bar{m}'_1 \cdot m_2)(\bar{m}_2 \cdot m'_1)a_2 = \\ &= (\bar{m}'_1 \cdot \hat{a}) \left(\sum_{j=1}^{2} m_j (\bar{m}_j \cdot) \right) m'_1 = \bar{m}'_1 \cdot \hat{a} m'_1. \end{aligned} \tag{24}$$

In this equation the operator $\hat{a}$ corresponds to the observable a and acts on the set of possibilities. As the set of eqs. (16) must be satisfied, this set of possibilities has a structure of a linear vector space over a set of complex numbers. If so, this operator also must be linear and defined by the following equation:

$$\hat{a} m_j = a_j m_j \qquad (j = 1, 2), \tag{25}$$

known as the eigenequation of the operator $\hat{a}$. The numbers a_j are the eigenvalues of the operator , and m_j satisfying this equation are the "eigenpossibilities" of the operator. The set $\{a_j\}$ is the spectrum of the operator $\hat{a}$ and contains all admissible results of measurements of observable a.

Having performed an analogous reasoning for observable b, we arrive at the following expression for the expected value of this observable in a given state, e.g. in the state determined by the possibility m_2:

$$\bar{b}_{m_2} = \bar{m}_2 \cdot \hat{b} m_2, \tag{26}$$

where

$$\hat{b} m'_j = b_j m'_j \qquad (j = 1, 2), \tag{27}$$

and $\hat{b}$ is the operator corresponding to observable b.

We shall show now that the product of the operators $\hat{a}$ and $\hat{b}$ cannot be commutative, i.e. that

$$\hat{a}\hat{b} \neq \hat{b}\hat{a}. \tag{28}$$

To show this let's act with the operator $\hat{b}$ from the left hand side on the eigenequation (25):

$$\hat{b}\hat{a} m_j = \hat{b} a_j m_j = a_j \hat{b} m_j. \tag{29}$$

Assuming that $\hat{a}\hat{b} = \hat{b}\hat{a}$ and denoting

$$m''_j = \hat{b}m_j \tag{30}$$

from eq. (28) we get:

$$\hat{a}m''_j = a_j m''_j. \tag{31}$$

So, the possibilities m_j and m'_j satisfy the same equation for identical eigenvalues, which means that they can differ only by a constant, denoted as b_j. Hence:

$$m''_j = b_j m_j. \tag{32}$$

If so, the chain of measurements (4) would end at the measurement

$$m'_1 = \{m_1, m_2\} \to m_1 = m'_1 \tag{33}$$

and $\mathcal{O}$ would not have a possibility of further choice. Therefore, the operators $\hat{a}$ and $\hat{b}$ have to meet condition (28).

Further limitations as to the form of the operators $\hat{a}$ and $\hat{b}$ follow from the fact that since the eigenvalues a_j and b_j are measurable, they must be real numbers. Taking into account condition (22) the operator $\hat{a}$ is rewritten in the form:

$$\begin{aligned} \hat{a} &= 1\hat{a}1 = \sum_{j=1}^{2} m'_j(\bar{m}'_j \cdot)\hat{a} \sum_{j'=1}^{2} m'_{j'}(\bar{m}'_{j'} \cdot) = \\ &= \sum_{j=1}^{2}\sum_{j'=1}^{2} m'_j(\bar{m}'_j \cdot \hat{a}m'_{j'})(\bar{m}'_{j'} \cdot). \end{aligned} \tag{34}$$

The set of expressions $(\bar{m}'_j \cdot \hat{a}m'_{j'})$ represents the operator $\hat{a}$ and can be expressed in the form of a matrix

$$\check{a} = \left\| \begin{array}{cc} \bar{m}'_1 \cdot \hat{a}m'_1 & \bar{m}'_1 \cdot \hat{a}m'_2 \\ \bar{m}'_2 \cdot \hat{a}m'_1 & \bar{m}'_2 \cdot \hat{a}m'_2 \end{array} \right\|. \tag{35}$$

Following the procedure known from algebra, we can calculate the eigenvalues a_j of the operator $\hat{a}$, as the values of a for which the matrix determinant is zero

$$\det\left(\check{a} - a \left\| \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array} \right\| \right) = 0. \tag{36}$$

Eq. (36) takes the form of a square equation with respect to the unknown a:

$$\begin{aligned} a^2 &- a\left((\bar{m}_1' \cdot \hat{a}m_1') + (\bar{m}_2' \cdot \hat{a}m_2')\right) + \\ &+ (\bar{m}_1' \cdot \hat{a}m_1')(\bar{m}_2' \cdot \hat{a}m_2') - (\bar{m}_1' \cdot \hat{a}m_2')(\bar{m}_2' \cdot \hat{a}m_1') = 0. \end{aligned} \tag{37}$$

It is easy to check that for a to assume real values it is enough that

$$(\bar{m}_1' \cdot \hat{a}m_2') = \left((\bar{m}_2' \cdot \hat{a}m_1')\right)^*, \tag{38}$$

so that $\hat{a}$ was Hermitian, as then the discriminant of eq. (37) is positive. In general the requirement for the operator to be Hermitian can be written as:

$$\bar{m} \cdot \hat{a}m' = \left(\bar{m}' \cdot \hat{a}^\dagger m\right)^* \quad \text{and} \quad \hat{a} = \hat{a}^\dagger. \tag{39}$$

Similarly for the operator $\hat{b}$

$$\bar{m} \cdot \hat{b}m' = \left(\bar{m}' \cdot \hat{b}^\dagger m\right)^* \quad \text{and} \quad \hat{b} = \hat{b}^\dagger, \tag{40}$$

where operatorors $\hat{a}^\dagger$ and $\hat{b}^\dagger$ are the operators adjoint with $\hat{a}$ and $\hat{b}$, respectively.

Let's also note that the "fluctuation operators" of the observables a and b:

$$\Delta\hat{a} := \hat{a} - \bar{a}_m \tag{41}$$

and

$$\Delta\hat{b} := \hat{b} - \bar{b}_m \tag{42}$$

are also self-adjoint. Indeed,

$$\begin{aligned} \bar{m} \cdot \Delta\hat{a}m' &= (\bar{m} \cdot \hat{a}m') - \bar{a}_m(\bar{m} \cdot m') = \\ &= (\bar{m}' \cdot \hat{a}m)^* - \bar{a}_m(\bar{m}' \cdot m)^* = (\bar{m}' \cdot \Delta\hat{a}m)^*. \end{aligned} \tag{43}$$

Taking into account one of the conditions (9) we get:

$$\bar{m}' \cdot m' \geq 0. \tag{44}$$

Let

$$m' = \hat{d}m, \tag{45}$$

where $\hat{d}$ is the operator defined as

$$\hat{d} = x\Delta\hat{a} + i\Delta\hat{b}, \tag{46}$$

and x is a certain real number and $i = \sqrt{-1}$.

Having substituted (45) to (44), and used the condition $\bar{m}' \cdot \hat{d}m = \left(\bar{m} \cdot \hat{d}^\dagger m'\right)^*$, we get:

$$\bar{m}' \cdot m' = \bar{m}' \cdot \hat{d}m = \left(\bar{m} \cdot \hat{d}^\dagger m'\right)^* = \left(\bar{m} \cdot \hat{d}^\dagger \hat{d}^\dagger m\right)^* \geq 0. \tag{47}$$

Hence

$$\begin{aligned}
\bar{m} \cdot \hat{d}^\dagger \hat{d} m &= \left(\bar{m} \cdot (x\Delta\hat{a} - i\Delta\hat{b})(x\Delta\hat{a} + i\Delta\hat{b})m\right) = \\
&= x^2 \left(\bar{m} \cdot (\Delta\hat{a})^2 m\right) + ix\left(\bar{m} \cdot (\Delta\hat{a}\Delta\hat{b} - \Delta\hat{b}\Delta\hat{a})m\right) + \\
&+ \bar{m} \cdot (\Delta\hat{b})^2 m \geq 0
\end{aligned} \tag{48}$$

and, because the first and the third terms must be positive, this inequality will be satisfied when:

$$-\left(\bar{m} \cdot (\Delta\hat{a}\Delta\hat{b} - \Delta\hat{b}\Delta\hat{a})m\right)^2 - 4\left(\bar{m} \cdot (\Delta\hat{a})^2 m\right)\left(\bar{m} \cdot (\Delta\hat{b})^2 m\right) \leq 0. \tag{49}$$

After some transformations, this inequality takes the form of Robertson inequality [8]:

$$(\Delta a_m)^2 (\Delta b_m)^2 \geq -\frac{1}{4}\left(\bar{m} \cdot [\hat{a}, \hat{b}]\ m\right)^2, \tag{50}$$

where

$$\Delta a_m = \sqrt{\bar{m} \cdot (\Delta\hat{a})^2 m} \tag{51}$$

and

$$\Delta a_m = \sqrt{\bar{m} \cdot (\Delta\hat{b})^2 m} \tag{52}$$

are standard deviations from the expected values of the observables a and b in the state corresponding to the possibility m. The symbol

$$[\hat{a}, \hat{b}] = \hat{a}\hat{b} - \hat{b}\hat{a}, \tag{53}$$

stands for a commutator of the operators $\hat{a}$ and $\hat{b}$.

If the product of $\hat{a}$ and $\hat{b}$ is not commutative, the right hand side of the inequality (50) is different from zero and the commutator (53) must take the form:

$$[\hat{a}, \hat{b}] = i\hat{c}, \tag{54}$$

where $\hat{c}$ is a certain Hermitian operator $\hat{c} = \hat{c}^{\dagger}$. Hence, a measurement of the observable a, which implies that $\Delta a_m = 0$, means that it is impossible to predict a result of measurement of the observable b, and vice versa, measurement of b makes it impossible to predict a result of measurement of a.

In this way we have shown independently that the condition of the product of the operators $\hat{a}$ and $\hat{b}$ to be noncommutative is necessary for $\mathcal{O}$ to have a permanent freedom of choice within certain limits, determined by the admissible set of possibilities.

The operator $\hat{c}$ cannot be a real number, because none of the operators $\hat{a}$ and $\hat{b}$ have a continuos spectrum of eigenvalues. Therefore, there must be an observable c corresponding to the operator $\hat{c}$, describing the system studied. Hence, the state of the system is not described by the two observables a and b, but at least three observables: a, b and c. Assuming that only these three observables describe the system, the operator $\hat{c}$ cannot be a function of the other two operators, and the other two commutative relations have to be satisfied:

$$[\hat{b}, \hat{c}] = i\hat{a}, \tag{55}$$

$$[\hat{c}, \hat{a}] = i\hat{b}, \tag{56}$$

with the accuracy to a constant. Together with (54) they describe the algebra of operators corresponding to the observables of our system.

Let's assume that similarly as the operators $\hat{a}$ and $\hat{b}$, the operator $\hat{c}$ meets the eigenequation in the form:

$$\hat{c}m''_j = c_j m''_j, \tag{57}$$

where $j = 1, 2$, and

$$\bar{m}''_j \cdot m''_j = \delta_{j,j'} \tag{58}$$

and

$$\sum_{j=1}^{2} m''_j(\bar{m}''_j \cdot) = 1. \tag{59}$$

In this way the set of possibilities m_j and m'_j is enlarged by the possibility m''_j. It is a very interesting result, which means that not only $\mathcal{O}$ has a permanent possibility of choice of the result of measurement, but also physicists $\mathcal{C}_n$ have a permanent choice of at least one of the two observables, for which it is impossible to predict a result of measurement.

According to equations (4) and (18), the process of decision making by $\mathcal{O}$ during the measurement of the observable a of the system, whose state is described by the possibility m'_1, can be expressed as follows

$$m'_1 = \sum_{j=1}^{2} (\bar{m}_j \cdot m'_1) m_j \to m_1 \text{ or } m_2 \tag{60}$$

or a dual relation

$$\bar{m}'_1 = \sum_{j=1}^{2} (\bar{m}'_1 \cdot m_j) \bar{m}_j \to \bar{m}_1 \text{ or } \bar{m}_2. \tag{61}$$

Analogously, measurement of the observable c of the system in the same state is described by

$$m'_1 = \sum_{j=1}^{2} (\bar{m}''_j \cdot m'_1) m''_j \to m''_1 \text{ or } m''_2, \tag{62}$$

$$\bar{m}'_1 = \sum_{j=1}^{2} (\bar{m}'_1 \cdot m''_j) \bar{m}''_j \to \bar{m}''_1 \text{ or } \bar{m}''_2. \tag{63}$$

Because of these relations, the elements of the set of possibilities can satisfy the following conditions (apart from relation (9)):

$$\begin{aligned}
& m + m' = m' + m, \\
& m + (m' + m'') = (m + m') + m'', \\
& (z_1 + z_2) m = z_1 m + z_2 m, \\
& z(m_1 + m_2) = z m_1 + z m_2, \\
& z_1 (z_2 m) = (z_1 z_2) m, \\
& 1m = m, \quad 0m = m_0, \\
& m + m_0 = m, \; z m_0 = 0, \; (\bar{m}_0 \cdot m_0) = 0,
\end{aligned} \tag{64}$$

where m_0 is the zero possibility corresponding to no real possibility.

The above-presented properties of the set of possibilities are the same as those of a Hilbert space $\mathcal{H}$ ($m \in \mathcal{H}$). The set of all continuous functionals on the Hilbert space $\mathcal{H}$ is the so-called dual space to $\mathcal{H}$, denoted by $\mathcal{H}^*$. The elements of the dual space $\mathcal{H}^*$ are the dual possibilities $\bar{m}$, so $\bar{m} \in \mathcal{H}^*$.

4 Fundamentals of the quantum theory

Above we have constructed the mathematical formalism describing the process of decision making by $\mathcal{O}$, referring to physical phenomena. For the sake of simplicity we have considered a physical system characterised by only three observables a, b and c, each of which can take two values. The formalism can be easily generalised on any isolated physical system. The formalism describing the process of decision making by $\mathcal{O}$ is identical to the basic skeleton of the quantum theory. This fact supports the hypothesis that the structure of the quantum theory principles reflects the fact that quantum processes occur according to proposed ontology in the omniscience $\mathcal{O}$.

To prove this identity we shall introduce the notation proposed by Dirac [9] and commonly used in the quantum theory. Let's denote the possibility as

$$m = |\Psi\rangle, \tag{65}$$

where $|\Psi\rangle$ is known as the state vector "ket", while

$$\bar{m} = \langle\Psi| \tag{66}$$

is the state vector "bra". In this notation the eigenequations for the operator $\hat{a}$ (25) can be rewritten in the form

$$\hat{a}|a\rangle = a|a\rangle \tag{67}$$

or

$$\langle a|\hat{a} = \langle a|a \tag{68}$$

the condition of orthonormality (10), assuming that $\bar{m} \cdot m' = \langle\Psi| \cdot |\Psi\rangle = \langle\Psi|\Psi\rangle$, in the form

$$\langle a|a'\rangle = \delta_{a,a'} \tag{69}$$

and the completeness condition (22) as

$$\sum_a |a\rangle\langle a| = 1. \tag{70}$$

Equation (24) for the expected value of the observable a, corresponding to the Hermitian operator $\hat{a} = \hat{a}^\dagger$, in the state $|\Psi\rangle$ takes the form

$$\bar{a}_\Psi = \langle\hat{a}\rangle_\Psi = \langle\Psi|\hat{a}|\Psi\rangle. \tag{71}$$

The Robertson inequalities (see eq.(50)), which express the Heisenberg uncertainty relations in the Dirac notation can be written as

$$\begin{aligned} \Delta a_\Psi \Delta b_\Psi &\geq \frac{1}{2}\Big|\langle\hat{c}\rangle_\Psi\Big|, \\ \Delta b_\Psi \Delta c_\Psi &\geq \frac{1}{2}\Big|\langle\hat{a}\rangle_\Psi\Big|, \\ \Delta c_\Psi \Delta a_\Psi &\geq \frac{1}{2}\Big|\langle\hat{b}\rangle_\Psi\Big|, \end{aligned} \tag{72}$$

where

$$\begin{aligned} \Delta a_\Psi &= \sqrt{\langle\Psi|(\Delta\hat{a})^2|\Psi\rangle}, \\ \Delta b_\Psi &= \sqrt{\langle\Psi|(\Delta\hat{b})^2|\Psi\rangle}, \\ \Delta c_\Psi &= \sqrt{\langle\Psi|(\Delta\hat{c})^2|\Psi\rangle} \end{aligned} \tag{73}$$

and

$$\Delta\hat{c} := \hat{c} - \langle\hat{c}\rangle_\Psi. \tag{74}$$

The process of measurement of the observable a of the system in the state $|\Psi\rangle$ is described by the relations:

$$|\Psi\rangle = \sum_a \langle a|\Psi\rangle|a\rangle \rightarrow |a'\rangle \tag{75}$$

or

$$\langle\Psi| = \sum_a \langle\Psi|a\rangle\langle a| \rightarrow \langle a'|, \tag{76}$$

following from formulas (60) and (61).

Because of the possibility of expressing each vector of state by a linear complex superposition of eigenstates, as in formulas (75) and

(76), all operators of observables acting in the Hilbert space of state vectors ($|\Psi\rangle \in \mathcal{H}$), must satisfy the condition of linearity known as the principle of superposition of states [9],

$$\hat{b}\left(z_1|\Psi_1\rangle + z_2|\Psi_2\rangle\right) = z_1\hat{b}|\Psi_1\rangle + z_2\hat{b}|\Psi_2\rangle, \tag{77}$$

for any complex numbers z_1 and z_2 and for any state vectors $|\Psi_1\rangle$ and $|\Psi_2\rangle$.

Finally, the formula for the probability of getting a value a' as a result of measurement of the observable a for the system in the state $|\Psi\rangle$, according to formulas (20), takes the form of the Born postulate [4]

$$p\left(|\Psi\rangle \rightarrow |a'\rangle\right) = \left|\langle a'|\Psi\rangle\right|^2. \tag{78}$$

The formulas (65-78) are indeed the fundamental equations describing any realisation of the quantum theory [1], [10], [11]. They make the first, second and fourth basic elements of the quantum theory but they do not determine the space of states of a specific physical system and its evolution. This observation also supports the hypothesis that the quantum processes take place in an omniscience $\mathcal{O}$.

We note that a dynamical equation in the quantum cosmology of a closed universe has the time-independent form (form of eigenequation (25)) [2], [3], [12]. In the absence of the concept of absolute time, the ordinary dependence of the Schrödinger equation on the time parameter is here replaced by the correlations between the dynamical variables which include all physical clocks. Quantum cosmology suggested that time is a semiclassical concept [12], which cannot be extended to the quantum gravity domain, that is, to the region in which fluctuations of the gravitational field are important.

5 Interpretation of results and conclusions

The necessity of inclusion of a conscious observer $\mathcal{C}_n$ (in our notation) to the scheme of the quantum theory has been for the first time indicated by Charles G. Darwin [13] in 1929 and next developed by John von Neumann [14], who proposed the so-called orthodox interpretation of the theory. He assumed all the ideas of the Copenhagen school, but contrary to Bohr [15] he ascribed the same status to the measuring apparatus as to the microscopic object under measurement – the two systems are described by the linear equations of the quantum theory. However, quantum measurement cannot be ended within the linear quantum mechanics [14], [16]. A measurement performed in a microscopic system can be illustrated by the following example. Let's assume that we have a measuring device which can inform us whether a certain molecule has undergone decay. This device can be sufficiently accurately described in terms of classical physics. Two mutually exclusive results of measurement are possible and the quantum theory enables a calculation of their probabilities. When we want to check the indication of the measuring device we have to illuminate it. The quantum theory allows a calculation of the probability that light will be reflected in this or that direction. This process lasts as long as we realise in our mind that the experiment gave this and not that result and reject one of the possibilities.

In the quantum theory we use the notion of the vector of state, which is a mathematical object carrying our knowledge about a given system. After a measurement we have to replace the old vector of state by a new one in which the information from the measurement is included. The knowledge however, requires a subject who has it. Therefore, Darwin and von Neumann assumed that a reduction of the superposition of states at the moment of measurement is made in the mind of a conscious observer $\mathcal{C}_n$ who accepts the result of the measurement [14]. That is why a conscious observer $\mathcal{C}_n$ cannot be replaced by a device or a living creature devoid of conscious mind. Disregarding the fact that the human mind is a physical object, the orthodox interpretation rejects the assumption that the quantum theory is capable of describing human mind (or the mind of any other conscious being) with its consciousness and knowledge.

The assumption that the reduction of superposition takes place in the mind of the experimenter has introduced a philosophical thesis of epistemological character. It leads to a recognition of the influence of human mind on the external physical world. All speculations following from Darwin and the von Neumann ideas seem nonessential relative to the postulated connection between the object under observation and the measuring device with the observer $\mathcal{C}_n$. In the terms of classical physics the observer is nonessential. The repeatability of the results of measurements, their verification and the possibility of the formulated theories to predict new facts have contributed to developing a special cognitive procedure, objective and independent of the observer. Therefore, all epistemological controversies have been beyond physics. The problem that has long been a subject of concern for philosophers – how human beings learn about the world, what is the relationship between the mind and the physical world – has been beyond physics just because of the specific procedure of getting information. Only the proposition of von Neumann revealed the irreducibility of the conscious observer existence at the very act of measurement. The idea of a consciousness reducing the superposition of states reflects the old question about the nature of human cognition. The question appears because von Neumann gave a specific answer. The physicists have to realise that the methodological procedure used in the field belongs to the cognitive process of human beings and that they will not avoid the problems originating in the theory of cognition.

The orthodox interpretation has been attacked with seven main objections:

- Assumption that the human mind $\mathcal{C}_n$ is subjected to other laws than the rest of the physical world implies that the mind does not belong to the physical reality, which creates difficult mind-body questions. This interpretation uses the notion of consciousness $\mathcal{C}_n$, and requires a theory of perception and a theory explaining the functioning of the mind, but has nothing to say about them itself. Moreover, it does not explain the difference between the measuring device and the observer or why the mind does not perceive the superposition of states.

- The consciousness $\mathcal{C}_n$ of the mind has not been a well-defined concept, so this interpretation can be treated as just an attempt.

- This interpretation implies a difficult to accept status of the universe existence in the time when there were no conscious observers $\mathcal{C}_n$. This problem has been presented in a grotesque form in 1935 by Schrödinger as the so-called Schrödinger cat paradox. Thus, the interpretation proposed by von Neumann can hardly be applied for quantum cosmology.

- The orthodox interpretation does not explain the relativity of the process of reduction of the superposition of states with respect to the position of the observer, which is often expressed in the form of the Wigner's friend paradox [4].

- It assumes that the human mind $\mathcal{C}_n$ is responsible for creation of physical reality.

- The interpretation does not propose the image of reality, which would reconcile the existence of immediate correlations in quantum spatial systems with a relativistic concept of simultaneity of events.

- The interpretation can hardly answer the question whose knowledge is represented by the vector of state (reduced density operator) describing the mind of a conscious observer $\mathcal{C}_n$.

The assumption, valid in the orthodox interpretation, that the human mind is beyond the quantum theory, leads to a dualistic concept of nature according to which the reality consists of two different elements: that described by the quantum theory and that made of conscious and active mind substance $\mathcal{C}_n$ which cannot be described by the quantum theory.

In the orthodox von Neumann interpretation it is assumed that the first element, described by the quantum theory is passive material substance. In my opinion this assumption is a source of the most difficult problems in this interpretation of the quantum theory because it entangles this theory in a hopelessly difficult mind-body problem. This situation can be avoided assuming that this first element is not made of matter but of ideas transmitted to human minds $\mathcal{C}_n$ by omniscience $\mathcal{O}$. The laws of physics (quantum theory principles) govern only the rules of transmission of the ideas and do not describe the mind being their source.

In order to explain the puzzling correlations and EPR we have to assume that the transmission of ideas among the human minds $\mathcal{C}_n$ and $\mathcal{C}_{n'}$ $(n \neq n' = 1, 2, \ldots)$ can take place only through the intermediacy of $\mathcal{O}$ and according to certain rules known as the laws of physics. Under this assumption, $\mathcal{O}$ plays a role of a specific nonlocal hidden parameter, which couple distant spacetimes of events. Indeed $\mathcal{O}$ is a hidden parameter since, like human minds, it belongs to the reality transcendent to the empirical-mathematical method of physical studies.

Using a simple mathematical formalism it has been shown that if the process of decision making by $\mathcal{O}$ refers to a choice of a certain physical observable expressed by a real number, this process of decision making can be identified with the quantum theory principles. This explains the process of quantum measurement and exact linearity of the quantum theory. In between the moments of quantum measurements $\mathcal{O}$ "considers" all admissible variants of the answer which can exist at the moment of measurement. In the mathematical language it means a complex linear superposition of states i.e. all admissible possibilities. At the moment when a physicists (a human mind) $\mathcal{C}_n$ asks (makes a measurement by appropriate measuring apparatus), $\mathcal{O}$ giving an answer performs a jumpwise reduction of the superposition of possibilities. The jumpwise reduction occurs when at least one human mind $\mathcal{C}_n$ learns or could infer from observation of some macroscopic object – which possibility has been realised. This concept is fully consistent with the orthodox interpretation of quantum measurements proposed by von Neumann [14] but avoids the known paradoxes haunting this interpretation such as the Schrödinger's cat paradox and the Wigner's friend paradox [4]. The paradoxes are solved by assuming that the reduction of possibilities occurs by a decision made by $\mathcal{O}$ and not only by a change of the knowledge of a conscious observer $\mathcal{C}_n$ (as it was assumed by von Neumann).

Each next answer is correlated with the preceding one, in consistence with the quantum theory and space of states of the system. The proposed ontology predicts the existence of two kinds of changes of the quantum states: a linear change of possibilities, when the system is not observed and a jumpwise change at the moment of measurement.

An important conclusion following from inequality (72) is that not only $\mathcal{O}$ has a permanent possibility of choice when making a decision about a measurement, but also physicists $\mathcal{C}_n$ always have a possibility of choice of at least one of two observables, for which an accurate prediction is not possible. This possibility of choice for the physicists appears as a result of the fact that the system is described by physical quantities (observables) expressed by real numbers. The fact of the possibility of choice explains a puzzling finding that the nature can be described in terms of the language of mathematics.

The first is obvious, while the second follows from the fact that transferring decisions to human minds $\mathcal{C}_n$ by $\mathcal{O}$ is a non-spacetime process. This is a consequence of the fact that the spacetime is a secondary reality with respect to the Hilbert space of possibilities. The spacetime is a reality spanned in our minds $\mathcal{C}_n$ by $\mathcal{O}$ as a result of the transfer of ideas.

All contemporary formulations of the quantum theory are marred with a serious problem – they are consistent with the theory of relativity only when they describe evolutions of possibilities (quantum states) to this or that actualization at the moment of measurement, while at the moment of quantum measurement they give a reflection of reality inconsistent with this theory. These formulations do not explain how to reconcile the nonlocal features of the quantum theory with the relativity of the notion of simultaneity in the theory of relativity when making measurements in the correlation experiments. This reconciliation is easy in the interpretation proposed in which $\mathcal{O}$ plays the role of an instantaneous connection between remote spacetime events. The equations of physics describing the evolution of possibilities are symmetric with respect to the change in the direction of time. Hence, they suggest that the past and future have a similar status. The physics also includes a process of quantum measurement, in which a jumpwise reduction of the possibilities takes place as a result of a decision made by $\mathcal{O}$ and transferred to the human minds $\mathcal{C}_n$. The subsequent decisions of $\mathcal{O}$ we feel as the irreversible elapse of time.

This interpretation of time also explains its perplexed feature discovered by the theory of relativity. According to the theory of relativity the present does not exist. The present of one man is different than the present of another moving with respect to the first. For one of them a given event may belong to a definite past, while for another to unknown future. Also the sequence of events may be different for one observer than for another, therefore, it cannot be stated that one of the events is certain while the other is not. The notion of the present makes sense only for a definite human mind $\mathcal{C}_n$. Thanks to the existence of $\mathcal{O}$ transmission information to human minds $\mathcal{C}_n$ according to certain rules, there is no conflict between the relativity of the notion of simultaneity and a jumpwise reduction of possibilities and relativity of the cause and effect relations. The interpretation presented explains this fundamental problem appearing continually at any attempt to reconcile the two basic theories of contemporary physics – the theory of relativity and the quantum theory. So, in the interpretation proposed nonlocality of the quantum theory is explained as an effect of non-spacetime correlation of molecules by $\mathcal{O}$ who makes consistent the results of observations of once coupled and then distant particles.

In conclusion, it should be emphasised that thanks to the use of mathematics for description of $\mathcal{O}$ making sovereign decisions on physical reality, the interpretation proposed is the only one to explain the origin of the quantum theory principles and its mathematical formalism. Moreover, the description of the reality it gives reconciles the quantum theory with the theory of relativity.

If the interpretation is correct, the principles of the quantum theory will remain a permanent element of a future quantum theory of gravitation. Of course it does not solve an extremely difficult problem of construction of the quantum theory of gravitation but indicates a direction of such a construction.

The disputes and arguments on the meaning of the quantum theory, which started in the 20s of the 20$^{\text{th}}$ century, have been hitherto unresolved. Many equally apparently sensible interpretations of this theory have been proposed [4]. That is why the theory, although works excellently, remains a source of confusion for many physicists who incline not to take its fundaments seriously. The interpretation proposed in this work shows that they can be taken seriously and suggests that the fundamentals of the contemporary formulation of the quantum theory will remain permanent element of a future quantum theory of gravitation.

Concluding we can say that proposed ontology – general model of reality – explains the mathematical frameworks of the fundamental physical theory – quantum theory and its interpretational problems. It has been shown that the basic postulates of the quantum theory are a simple consequence of this ontology. From the point of view of this ontology, the postulates of the quantum theory are only implications following from more general concepts – existence of the omniscience. Moreover, proposed ontology indiates that the quantum theory principles apply to the whole universe.

Appendix: Consequences of not introducing a generalized scalar product

Assume that the scalar product of two possibilities m_1 and m_2, denoted by the symbol $m_1 \cdot m_2$ satisfies, instead of eq. (8), the following relation

$$(cm)^* = cm, \tag{A.1}$$

where c is an arbitrary real number. Then, expressions (9) become:

$$\begin{aligned} &m \cdot m \geq 0, \quad m \cdot m' = m' \cdot m, \\ &m \cdot (c_! m' + c_2 m'') = c_1(m \cdot m') + c_2(m \cdot m''), \end{aligned} \tag{A.2}$$

for any m, m' and m'' any real numbers c_1 and c_2. Under these assumptions, the condition of mutual exclusion of possibilities (10) can be written as:

$$\begin{aligned} m_j \cdot m_{j'} = m_{j'} \cdot m_j = \delta_{j,j'}, \\ m'_j \cdot m'_{j'} = m'_{j'} \cdot m'_j = \delta_{j,j'}, \end{aligned} \tag{A.3}$$

and formulas (18) become:

$$\begin{aligned} m'_j &= (m_1 \cdot m'_j)m_1 + (m_2 \cdot m'_j)m_2, \\ m_j &= (m'_1 \cdot m_j)m'_1 + (m'_2 \cdot m_j)m'_2. \end{aligned} \tag{A.4}$$

The formula (36) determining the eigenvalues a takes a form of a quadratic equation

$$\begin{aligned} &a^2 - a\left((m'_1 \cdot \hat{a}m'_1) + (m'_2 \cdot \hat{a}m'_2)\right) + \\ &+(m'_1 \cdot \hat{a}m'_1)(m'_2 \cdot \hat{a}m'_2) - (m'_1 \cdot \hat{a}m'_2)(m'_2 \cdot \hat{a}m'_1) = 0. \end{aligned} \tag{A.5}$$

For the eigenvalues a to be real it is sufficient and necessary that

$$m'_1 \cdot \hat{a}m'_2 = m'_2 \cdot \hat{a}m'_1 = \hat{a}m'_1 \cdot m'_2. \tag{A.6}$$

The operator $\hat{a}$ satisfying this condition is known as a symmetric operator.

According to expression (28), a product of operators $\hat{a}$ and $\hat{b}$ cannot commutate. For the symmetric operators, eq. (54) takes the form:

$$[\hat{a}, \hat{b}]_{=}\hat{c}, \tag{A.7}$$

where the symmetric operator $\hat{c}$ cannot be a real number because it was assumed that the operators $\hat{a}$ and $\hat{b}$ have countable spectra of eigenvalues. Also, the operator $\hat{c}$ cannot be a function of operators $\hat{a}$ and $\hat{b}$. Assuming that the system is fully described by three observables corresponding to the symmetric operators $\hat{a}$, $\hat{b}$ and $\hat{c}$, two more commutation relations have to be satisfied with accuracy to a constant:

$$[\hat{b}, \hat{c}]_{=}\hat{a}, \tag{A.8}$$

$$[\hat{c}, \hat{a}]_{=}\hat{b}. \tag{A.9}$$

Expressing the operators $\hat{a}$, $\hat{b}$ and $\hat{c}$ in the matrix form in the basis of eigenpossibilities of e.g. operator $\hat{a}$, we see that there are not exist nonzero symmetric operators satisfying the commutation rules (A.7-A.9). This means that the non-generalised scalar product satisfying relations (A.2) cannot be used for description of the process of decision making referring to physical phenomena. That is why complex numbers must appear in the mathematical formalism of the quantum theory and the space of states in the quantum theory is the Hilbert space over a set of complex numbers.

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Comment by

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The main purpose of the paper is the introduction of quantum ontology which explains some unclear aspects of quantum theory e.g. the reduction of the superposition of states by a measurement. The ontology is based on the assumption that "there exists omniscience - absolute knowledge that is greatest possible to be conceived" (see postulate, p. 266). This is the only postulate of the ontology. According to Jacyna-Onyszkiewicz from the postulate it follows not only rules of quantum theory but also the existence of absolute love and the sense and value of human life ("omniscience which is absolute love wants people to exist so that it can create with each of them an independent relation of love"). The variety of things explained by the existence of omniscience is very impressive. Especially if we take into account Conclusion 3 which says that "The omniscience O is and will be an incomprehensible mystery for rational reasoning". In the light of this Conclusion it is a real mystery how we can obtain any knowledge about omniscience e.g Conclusion 5 which says that "..omniscience is an separable unity of the three objects..". So the omniscience is an incomprehensible mystery or not? In fact the situation is even more dramatic. Taking into account Conclusions 3 and 4 ("Apart from the omniscience O there is nothing else") one may ask: is physics really possible? How the science is possible? According to Jacyna-Onyszkiewicz physics is not only possible but cannot be understood without reference to omniscience. As an example Jacyna-Onyszkiewicz shows how mathematical formalism of quantum theory follows from the existence of omniscience. Moreover it turns out that each quantum measurement corresponds to the decision making by omniscience. The omniscience "in the act of decision making chose the possibility" corresponding to the result of the measurement. Hence the reduction of the superposition of states takes place because of the decision of omniscience. The problem is that the explanation (and the whole proposed interpretation of quantum theory) is based on faith that the omniscience really exists and possesses features described by Jacyna-Onyszkiewicz. However the existence of omniscience and its features are not obvious (at least for me). The Conclusions formulated by Jacyna-Onyszkiewicz are based on many additional assumptions which are essentially of religious rather than rational nature. Hence the proposed interpretation of quantum mechanics (e.g. explanation of the reduction of the superposition of states) seems to be beyond rational method. And if so then from my point of view such considerations have no scientific value. Finally I would like to notice that even if at present it is very difficult to modify quantum mechanics without falling into logical inconsistences nobody can assure that in the future a new theory will not be constructed which will provide us with deeper understanding of nature (and the reduction process). It is at least premature to exclude such situation. The history of science can be here a good teacher.