

"QUANTUM DISCRETENESS"

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ABSTRACT

The idea of "quantum computers" states that the discrete states of a quantum object can be used to create information bits. In this part of the text, we will show that the practical implementation of this idea will be impossible, since the arguments that are indicated as the basis of this implementation contradict the principles of quantum mechanics.

1: INTRODUCTION

Let's start the analysis with a note: in order to create an information bit, it is necessary to have two fully controlled discrete physical states connected by a mutual exclusion mechanism. Control implies that these states should be able to be turned on and off in the following manner: when we turn one state on, it should remain on until we turn it off. Turning off this state should automatically trigger the second state to turn on. Our goal is to analyze whether it is possible or not to create such controllable mechanisms using discrete quantum states. For example, when for a particle with half spin we "turn on" the state - $S_z = 1/2$, it must remain in the same state until us "turn it off". And when we "turn it off", the state - $S_z = -1/2$ should be "turned on".

To find out how feasible this is, it will be necessary to discuss in detail the properties of the spin characteristics.

Let's list the statements that will be considered in this part:

1: - Is the spin vector a physical characteristic, whose measurement result is necessarily a random variable?

Answer - According to the principles of quantum mechanics, physical characteristics of a quantum object, that can dynamically change, will be observed as random variables when measured. Therefore, the result of measuring the spin vector - must be a random variable.

2: - Do the results of the Stern-Gerlach experiment provide direct evidence that the results of the quantum spin vector observation are quantum – random quantities?

Answer - no, it does not.

3: - Is it possible to empirically show that the quantum spin vector is quantum - random variable?

Answer - yes, and to do so, the two beams - obtained in the Stern-Gerlach experiment, must be re-passed through a macroscopically similar magnetic field. If the individual, now "polarized" beams do not split back into two, then the corresponding spin characteristic will not be quantum random, but rather polarization-deterministic. If the beam splits back into two, then the spin characteristic will be fundamentally quantum random.

4: On what principle will the "information bit" generated by the "quantum transistor" of a half-spin qubit work – according to the principle of quantum randomness or polarization determinism?

Answer - according to the principles of quantum mechanics, both the "quantum transistor" and the "quantum computer" will have to work on the principle of quantum randomness.

2: – "SPIN" – A BRIEF HISTORY.

From a historical point of view, the most famous proof of the existence of spin is the Stern-Gerlach experiment (see [1]). At the time this experiment was conducted, no one knew about the existence of the spin phenomenon, and the purpose of the experiment was to observe and test a completely different phenomenon. Namely, the existence of spatial discreteness of orbits followed from the "planetary model" of the atom. If such discreteness really existed, then the phenomenon of discreteness of the orbital moment would also exist. From this model, it also followed that some electrons - moving in atomic orbits, can also have zero orbital momentum (see, e.g., [2]), which raised great doubts – how can one attribute a zero numerical value to the orbital momentum of an object that moves in orbit? At the initial stage of introducing this phenomenon in reasoning, it was perceived only as a mathematical abstraction, which makes it possible to carry out mathematical calculations. But Stern had an idea – perhaps this mathematics corresponds to a real physical phenomenon and the "Stern-Gerlach experiment" was aimed at testing this idea. To do this, a stream of silver atoms resulting from thermal emission was passed through an inhomogeneous magnetic field. The interaction with the inhomogeneous magnetic field of the magnetic moments of electroneutral silver atoms created by the orbital moments of the constituent parts of the atoms should have caused a change in the trajectories of the flow atoms. Among the many discrete trajectories, it was especially interesting to observe those that would not change direction, which would correspond to the zero value of the orbital angular momentum. In the experiment, it was found that the original stream was divided into two, which confirmed the presence of spatial discretization.

The result obtained indicated that the silver atom has a strange property - in an external magnetic field, the magnetic moment of the atom acquires only two opposite directions. For a while, this result was one of the inexplicable results, since the number of trajectories - two, contradicted both zero and other integer values of the orbital momentum. Although - no one paid attention to this, since the main goal was achieved - the existence of the phenomenon of spatial discretization was shown.

A few years after this experiment, the idea of the existence of a strange magnetic moment was recorded in a scientific publication by Uhlenbeck and Goudsmit (see [3]). On Uhlenbeck's initiative, this strange magnetic moment was called spin. The name comes from the idea that, despite the strangeness, this

magnetic moment should be attributed to the electron as if the electron were doing some kind of rotation of its own, like an extended object. It should also be noted that the original idea of spin was related to studies of atomic spectra, and not to the result of the Stern-Gerlach experiment. A year before this publication, Pauli's article was published in which he pointed out the possible existence of a strange property of electrons, which induced the presence of an equally strange phenomenon of "prohibition" for electrons in atomic orbits.

As Goudsmit describes in his memoirs (see [4]), Uhlenbeck and he did not fully believe in the validity of spin's ideas and asked Ehrenfest not to send their manuscript for publication. But, as it turned out, Ehrenfest had already sent the text to the journal and so it appeared [3]. As it turned out later, the idea of spin turned out to be the key to explaining both the Pauli's "exclusion" phenomenon and the phenomenon of spatial discretization.

Since the electron was considered a point object and could not make its own rotations, the idea of spin raised questions. However, this idea has become firmly entrenched in the concepts of quantum mechanics, with one caveat: the electron does not actually rotate, but only - as if it were spinning. In order for this characteristic to interact with the magnetic field, which has a vector nature, the same vector nature was ascribed to this two-component spin moment as to ordinary orbital moments. According to the principles of quantum mechanics, the spin was matched with a corresponding operator whose algebraic properties are associated with the same spatial group of rotations to which the orbital moments were associated. As a result, a single-step mechanism was introduced in the discretization of numerical spin values, on the basis of which, with the numerical value of the spin parameter $S = 1/2$, a two-component spin state was generated. The spin operator was presented as:

$$\hat{S}^2 = \vec{e}_x \hat{S}_x + \vec{e}_y \hat{S}_y + \vec{e}_z \hat{S}_z ; \quad (2.1)$$

$\{\vec{e}_x; \vec{e}_y; \vec{e}_z\}$ — ords of physical space, and $\{\hat{S}_x; \hat{S}_y; \hat{S}_z\}$ - the spatial components of the spin operator. These operators satisfy the switching relations:

$$\hat{S}_x \hat{S}_y - \hat{S}_y \hat{S}_x = i\hbar \hat{S}_z ; \quad \hat{S}_y \hat{S}_z - \hat{S}_z \hat{S}_y = i\hbar \hat{S}_x ; \quad \hat{S}_z \hat{S}_x - \hat{S}_x \hat{S}_z = i\hbar \hat{S}_y ;$$

$$[\hat{S}^2, \hat{S}_x] = [\hat{S}^2, \hat{S}_y] = [\hat{S}^2, \hat{S}_z] = 0 ; \quad (2.2)$$

Therefore, in fixed quantum states, only the eigenvalue of \hat{S}^2 and any one component can be given simultaneously. If we implement spin operators using matrices, we get the so-called Pauli's matrices, and in this case - the operators \hat{S}_i commute not only with the \hat{S}^2 -operator, but also with the squares of the individual components, since these quadratic operators are proportional to the unit matrix and equal to each other:

$$\hat{S}_x^2 = \hat{S}_y^2 = \hat{S}_z^2 = \lambda^2 \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = (1/4) \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} ; \quad (2.3)$$

Note that these relations do not correspond to the physical requirements we have introduced, and arise only as a result of the matrix implementation of spin operators. In this respect, spin matrix operators differ from orbital momentum operators, in the case of which similar relations (2.3) are not realized. To write the eigenvalues of \hat{S}^2 , a parameterization similar to the eigenvalues of the orbital angular momentum is used:

$$\hat{S}^2 = S(S+1) \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} ; \quad (2.4)$$

A spin is called half-integer, if its vector length is equal to $|\vec{S}| = \sqrt{S(S+1)} = \sqrt{3}/2$. In this case, $\lambda = \pm 1/2$ and $S = 1/2$. As usual, together with $|\vec{S}|$, the z-component is chosen as the measured, the numerical values of which can be $S_z = \pm 1/2$.

With the help of such a physical characteristic, the result of the Stern-Gerlach experiment is also interpreted. But - the theoretical justification of this is not easy, since the silver atom consists of many electrons, protons and neutrons, and each of them must be assigned the same spin characteristic as the electron orbit. Under these conditions, the total magnetic moment of the silver atom should have remained two-component. The validity of the arguments supporting this possibility raises many questions, and, furthermore, we have been unable to determine who originated the idea of explaining the splitting of the silver atom flux in the Stern-Gerlach experiment using the spin of the electron in the silver atom's outer orbit. A certain idea has been formed, which is indicated in textbooks on quantum mechanics. Using the example of [5], we will briefly describe the argumentation of this idea and assess its scientific status: A silver atom consists of 47 electrons, 47 protons, 61 neutrons, and each is assigned a spin $S = 1/2$. In order to interpret the result of the Stern-Gerlach experiment with a high degree of certainty, it is necessary to show that the total spin of the silver atom will effectively correspond to the value of the spin at $S = 1/2$, and the magnetic moments, corresponding to the orbital moments of the components of the system, either do not affect the trajectory of the atom at all, or, if they do, then so insignificantly, that they can be neglected. To do this, we would have to solve the Schrödinger equation corresponding to the bound state of the silver atom, which is impossible with the mathematical methods at our disposal. When describing the discrete levels of many-body systems, the rule of simplified analogy is used: the energy levels of a many-particle bound system are built and ordered according to the same principles as the energy levels of a two-part hydrogen atom. And the same rules describe the discrete energy levels of the silver atom. The same rules describe the discrete energy levels of a silver atom. Obviously, this rule does not have a high scientific status. To the above rule is added the Pauli's exclusion principle, with the help of which atomic levels are constructed. Within the framework of these rules, the following idea of the structure of the silver atom was formed: 46 electrons of the silver atom completely fill the four energy levels. The last 47th electron is in the first orbital of the fifth energy level, which corresponds to the so-called S-term. The filling of each energy level begins with the zero numerical value of the orbital momentum and continues in the direction of increasing its numerical value. The filling of the fifth level begins with the last, the 47th electron, which is why it is assigned a zero numerical value of the orbital momentum. It is assumed that, as they move through their orbitals, all 46 electrons in the four occupied levels are combined into Pauli pairs with $S_z = \pm 1/2$, such that their total orbital momenta in pairs are either zero or very close to zero. According to the same Pauli's exclusion principle, the total spin magnetic moment of two electrons combined into Pauli's pairs is also zero. If we take into account the effect of spatial separation of electrons in a pair, we can say that the total moment of the two electrons is effectively close to zero, since the Z components of their spins are equal and oppositely directed. Although we know very little about the mechanism of the strong nuclear force, the same considerations apply to protons and neutrons in atomic nuclei, and the total spin of the silver atomic nucleus is either assumed to be zero or, because of the large masses of these components, the corresponding magnetic moment is quantitatively assumed to be very small. Both of these assumptions are supported by arguments of rather low reliability. In particular, the Pauli's prohibition principle applies to identical fermions that are in the same state. Separately, 46 protons and separately 60 neutrons can be considered as a Pauli pair combination, but the 47th and 61st neutrons cannot combine into a Pauli's pair, because they are not identical to each other. Therefore, equating their total spin to zero is not supported by real arguments. As for the significant mass of protons and neutrons compared to the mass of the electron, as a result of which the spin magnetic moments of protons and neutrons should be proportionally less than the corresponding magnetic moments of electrons, this argument seems logical at first glance. But it should be

borne in mind that when the 47th electron, as a result of the interaction of its spin magnetic moment with an inhomogeneous external field, changes the trajectory of the silver atom, its mass is effectively replaced by the total mass of the entire atom. Therefore, the statement based on the above arguments that the magnetic properties of a neutral silver atom are determined mainly by the spin magnetic moment of the outer electron is also not based on arguments with high scientific certainty. However, we will remain within the framework of these statements and continue to analyze the results obtained in the Stern-Gerlach experiment in the current format.

3: – INTERPRETATION OF THE RESULTS OF THE STERN-GERLACH EXPERIMENT

As we have already noted in the previous chapter, we will adhere to the statement that the magnetic properties of the silver atom are determined by the magnetic properties of the 47th electron located on the "S-term" of the fifth energy level. And since the orbital momentum of the S-terms is considered to be equal to zero, the result of the Stern-Gerlach experiment is explained by the following statement: the deviation of the trajectories of silver atoms is due to two possible numerical values of one component of the electron's spin vector. This component, quite conditionally, is chosen the Z-component of the spin vector. If the silver atom has a spin magnetic moment $\vec{H} = -e\vec{S}/m$ and the external magnetic field strength vector is \vec{B} , then the interaction potential is written as follows:

$$U = -\vec{B}\vec{H}; \quad (3.1)$$

If the direction of the inhomogeneity of the magnetic field coincides with the direction of the Z axis, the silver atoms will be affected by the force:

$$F_z = -\frac{\partial U}{\partial z} = \frac{\partial \vec{B}}{\partial z} \vec{H}; \quad (3.2)$$

which will deflect the trajectories of silver atoms in the same direction Z. If the direction of the lines of force of the external field coincides with the direction of the same axis Z, then the force will take the form:

$$F_z = -e S_z \frac{\partial B_z}{\partial z} /m; \quad (3.3)$$

Depending on the sign of the numerical values S_z , we get two streams of atoms deflected in mutually opposite directions. In this case, the angle between the spin vector and the directions of the magnetic field lines will be:

$$\cos\phi = S_z/|\vec{S}| = \pm\sqrt{3}/3; \quad (3.4)$$

The value of the angle $\phi = \arccos(\sqrt{3}/3)$ corresponds to the flux of atoms $c S_z = 1/2$, and $\phi = \arccos(-\sqrt{3}/3)$ corresponds to the flux $c S_z = -1/2$. When these values are realized using Pauli matrices, the direction of the vector \vec{S} is one of the four possible, which in turn are determined by the numerical values $S_x = \pm 1/2$ and $S_y = \pm 1/2$. In this case, the directions of the vector \vec{S} - although we cannot detect them in our observations, will have the same random character as the numerical values of S_z in this experiment.

For a correct physical interpretation of the result of the Stern-Gerlach experiment, it will be crucial to clarify what is meant by the statement about the random nature of the numerical values of the spin components. To clarify this, in the next subsection we will turn to the principles of mathematical statistics, which should work in the same way in all mechanics, both classical and quantum.

4: – WHETHER OR NOT THE RESULTS OF THE SPIN MEASUREMENT ARE A RANDOM VARIABLE.

Although the spin characteristic was introduced into discussions on the basis of phenomenological analysis of purely empirical facts, theoretical concepts of quantum mechanics, which were formed in the same period, played an important role in giving it physical essence. Below, we will understand both the essence of this characteristic and the scientific reliability of the physical arguments used in the formation of this essence. Let's start with a simple comparison: everyone agrees that the electron has mass, charge, and spin, the real existence of which can be observed in empirical facts. However, the mass is in a somewhat exceptional position. In particular, the fact of its existence is revealed both in the case of freely moving "Large and Heavy" bodies, and in the expression of potential energy corresponding to the law of universal gravitation. In the first case, mass is associated with the amount of inertia and therefore we call it "Inertial Mass". In the second case, there is a gravitational interaction and therefore these masses are called gravitational. After that, we say, after examining many experimental facts, we could not find any difference between the inertial and gravitational masses, and on this basis we introduced the principle of equivalence and identity of these two masses. This explains the participation of the same mass both in the momentum and in the kinetic energies of a freely moving body, as well as in the potential energies of interaction.

In the potential of the Coulomb interaction, in the same way, the charges of objects are involved, and no one says that these charges, in part or in full, belong to the Coulomb field. Everyone says that these charges belong to the corpuscular objects that carry them. Nevertheless, in mathematical expressions of freely moving charges, for example, in the corresponding Lagrangians and Hamiltonians, charge does not participate as a parameter of a certain physical characteristic. We explain this by the fact that, on the one hand, when a free electron moves, the charge does not manifest itself anywhere, and on the other hand, and most importantly, there are charges of the opposite sign, the sum of which, in terms of the intensity of interaction (in contrast to the masses), becomes less for the system of these charges than for individual parts of the system. This phenomenon is called "Shielding" and to describe the dynamics, it is quite enough to indicate the charges of the interaction potential.

Although the spin of a free-moving electron is not observed, and as we have pointed out in the case of the silver atom, the "Shielding properties" are also exhibited in the interactions, this characteristic has been attributed to the free electron. The main reason was that the purpose of the Stern-Gerlach experiment was to study the phenomenon of discreteness of orbital moments. And this characteristic is set in the same way for freely moving objects as mass, coordinate and momentum. Under these conditions, by analogy with the orbital momentum, it seemed quite logical that the fact of dividing the flow of atoms into two should be associated with the phenomenon of the discreteness of the magnetic moment. Therefore, and precisely by this analogy, the spin characteristic was attributed to freely moving objects, which was mathematically realized by the introduction of multicomponent state vectors. Thus, the spin characteristic became associated with the rotation group, which controls the number of components of the spin vector and the magnitude of these components.

Our goal is to understand the physical nature of spin at least partially. Since we are talking about the characteristics of objects in the microcosm, we will investigate the question from a statistical point of view and pose the question: What result would we obtain if we passed streams of silver atoms, formed in the Stern-Gerlach experiment, into the same non-uniform magnetic field in which these streams were formed? This question is discussed in some textbooks on quantum mechanics (see [5], [6]) and, based on the

theoretical considerations presented therein, it is believed that - if the fluxes formed in the seed experiment are repeatedly passed through, the streams formed in the seed experiment will no longer be divided into sub flows. It should be noted here that, like the "EPR paradox", this question is also considered in the form of a thought experiment. The main argument here is the idea of analogy – "as it happens in the case of polarized streams of light". We will discuss the properties of light separately, but here we will briefly note that, unlike the case of the electron, the spin property of photons does not correspond to the magnetic moment, since the photon has neither mass nor electric charge. And the term "polarization" is so general that it can be used to describe completely different processes. Therefore, the analogy with light cannot be considered a high-level scientific assumption. However, let's still follow the arguments presented in these textbooks, according to which the spin characteristic is represented as a magnetic arrow-shaped structure, which, when hit by a magnetic field, begins to rotate and assumes a certain spatial orientation. Let us assume that this theoretical assumption is correct, and if we observe one particular silver atom in repeated Stern-Gerlach experiments, according to the reasoning in [5] and [6], we get the following statistical picture: When we pass a stream of silver atoms into the first Stern-Gerlach device, then due to the thermionic origin of the atoms, we do not know the initial spatial direction of their "spin arrows", and therefore, these directions for us are random variables. It can be assumed that in the flow obtained by thermal emission, the directions of the "spin arrows" of atoms will be randomly distributed in space in all possible directions. When such a flux enters the inhomogeneous magnetic field of the Stern-Gerlach device, the Z-components of the "spin arrows" of one half of the atoms will line up in the direction of the gradients of the field lines, and their trajectories will deviate in the opposite direction. The z-components of the "spin arrows" of the other half of the atoms will be oriented in the opposite direction of the field line gradients, and their trajectories will deflect in the direction of these lines. According to [5] and [6], it should be assumed that after leaving the magnetic field, i.e. with the free movement of silver atoms, the direction of the mentioned "spin arrows" remains unchanged and coincides with the direction acquired by silver atoms in the magnetic field. Let's try to find out what direction these "arrows" will actually have. If the magnetic field lines of the Stern-Gerlach device at every point in space were directed exactly along the Z axis, then one would assume that the "spin arrows" of the freely moving silver atom - coming out of the field, would always be directed so that its Z-component remained unchanged. If the silver atoms coming out of this magnetic field fall into the same inhomogeneous magnetic field, the initial direction of the "spin arrows" of the atoms will be the same as when they hit the magnetic field of the first device. Therefore, both flows will be deflected only in the same directions as in the first case. This means that these polarized flows will no longer be divided into two sub-streams. In each subsequent macroscopic repeated experiment, the deflection of the flows will always be in the same direction until the direction of momentum of the silver atoms is so close to the direction of the Z axis that after entering the Stern-Gerlach device, they collide with the magnets of the device and cannot leave the device's area. However, such repeated observation is not our goal anyway, since even one repeated experiment will allow us to draw a conclusion with a fairly high degree of certainty: If in a macroscopic repeating experiment the flow of silver atoms does not split into two streams, this means that the initial directions of the Z-component of the "spin arrows" of silver atoms either coincide with the direction of the magnetic field gradient of the second device, or are slightly deviated from this direction, i.e. - by angles - significantly lower $\pi/2$. And in this case, we will get deterministically repeated results in each act of such repetition — the flow will never split into two parts.

Let's analyze this task more carefully and try to find out which picture can correspond to reality. At the same time, it should be remembered that the correct conclusion can only be obtained as a result of a real experiment, and not on the basis of theoretical reasoning. Therefore, in our reasoning we can only make assumptions: according to the "ideas of the Copenhagen School", when it comes to observing a micro-object: "God always plays dice with us", and we cannot find such a "mechanical device" with the help of

which we could predict in advance the outcome of our action, which occurs with the participation of one micro-object. As we mentioned in the first part of the text (see [10]), the reason for this is fundamental and is called the "Observer Factor". According to the principles of quantum mechanics, the effect of an inhomogeneous magnetic field on the quantum spin magnetic moment of a silver atom is for us a fundamentally uncontrollable action. Moreover, the reasoning that corresponds to the macroscopic picture of the experiment itself shows more than clearly that, based on knowledge of the direction of the magnetic field lines, we will not be able to indicate the direction of the "spin arrows" of silver atoms coming out of this field. The fact is that the spatial geometry of the directions of the magnetic field lines does not correspond to the "ideal box", inside which all the field force lines are directed along one definite spatial axis, and outside the "box" the field suddenly disappears, like the walls of the box itself. We do not know the mechanism by which the magnetic field gradient "adjusts" one component of the spin magnetic moment along its lines of force or in the opposite direction, but if we assume that this "adjustment" really takes place in the form of some kind of physical cooking of the "arrow", then when the atom leaves the magnetic field, the direction of the "arrow" will follow the direction of the gradient of the boundary lines of force. Given the knowledge of magnetic field lines, it is difficult to imagine that the direction of the boundary field lines will be the same as the direction of the field lines in the center of the magnet. Presumably, at a distance from the source, the field strength should continuously drop to zero, and the boundary lines of force cease to be straight lines and will be strongly curved. From the point of view of macroscopic accuracy, the difference between these directions may be small (although this difference is macroscopically observable), but for micro-objects a simple empirical principle applies - what may be small and unimportant for "Large and Heavy" bodies, for micro-objects is very large and very important. Quantum mechanics arose as a result of this principle. Someone may have the idea of making a rather long electromagnet and passing micro-objects through the field of such a magnet. And before these objects completely pass through the central area of the magnetic device, turn off the magnetic field so instantly that the objects do not have time to reach the boundary lines of force. Anyone, who has had the slightest connection with electrical engineering knows perfectly well that the act of turning on and off creates very large uncontrollable inhomogeneity's in the fields, and what effect these changes will have on the quantum spin polarization of objects is again beyond our control.

If our reasoning corresponds to reality (and most likely, it is), then the direction of quantum spin polarization of a quantum object coming out of the Stern-Gerlach device will turn out to be for us the same fundamentally random variable as the directions of the coordinates and momenta of micro-objects in observations. Therefore, when the silver atoms exit the first Stern-Gerlach device, we do not know what direction the "spin arrows" of the atoms will have before entering the second device. It is difficult to imagine that the spin of an electron behaves differently from all other dynamically changing characteristics. But if the reality suddenly turns out to be as described in textbooks [5] and [6], then spin physics will have to be transferred from quantum mechanics to classical mechanics, and significant changes in quantum mechanical concepts will be required. Until this question is empirically clarified, it would be much more consistent, within the framework of quantum mechanics, to consider that spin is an ordinary quantum characteristic and the results of the acts of observing it are always random.

5: – SPIN AS A QUANTUM TRANSISTOR?

As mentioned in the introduction to this part, our goal is to find out if discrete quantum states can be used to create controllable information bits. In order to obtain a controllable information bit, the corresponding quantum states must be "turned on and off" in the same way as in the case of a conventional light bulb. Let's look at what happens in the case of an ordinary light bulb: if we put a light bulb in the "on" state in a

dark room, it will remain in this state until we ourselves switch it to the "off" state. And no matter how many times we check whether the light bulb is "on" or not, it will always be "on" until we turn it off. Similarly, if we switch a light bulb to the "off" state, it will remain in the same state until we switch it to the "on" state. No matter how many times we repeat this action and observe the results of these actions, we will always get the same deterministic result. These two mutually exclusive states of said device can be used to create a controlled information bit. To do this, we need to be able to receive information whether the light bulb is on or not. Our goal is to find out whether it is possible to create such controllable devices using discrete states of a quantum object.

Let's start with a simple note: a device for storing information must be created by one specific quantum object, and the bit of information recorded in it must be stored by the same object for later use. From this point of view, it would be convenient to implement the creation of an information bit in the case of a completely isolated quantum object. But in this case, it would be impossible to control the location of this object in space, because when receiving information corresponding to the bit, the position of the specified object would change uncontrollably, and with further reversal, we would no longer know where to look for "our quantum device". Therefore, the standard option remains — the quantum object must be placed in an environment in which it will be easier to control its location. However, in this case, the problem will arise — to create an environment in which we could recognize "our quantum device" so as not to confuse it with similar but different quantum objects. Due to the principle of identity, this will be quite difficult.

Let's imagine that we have learned to use some "tricks" with the help of which we can "catch" quantum objects in such a way that, on the one hand, we can control their spatial position and, moreover, we can easily separate identical quantum objects from each other. Let's tie the information bit to the spin states of this object. To do this, in one quantum object, you will need to "turn on" the state $S_z = 1/2$ and "assign" the digit 1 or 0 to it. Let's say "appropriated" 1. The use of the term "assigned" makes sense only when the condition is met – no matter how many times we "call" this state in a "quantum computer", it is this state that must always be found – with the assigned number. On the other hand, any act of such a "call" is an "act of observing" the already prepared state $S_z = 1/2$. And according to the principles of quantum mechanics, in each act of observation, the quantum state that existed before the observation disappears and a new one is formed, which may or may not coincide with the state in which this object was before the observation. It turns out that although we have included state On the other hand, any act of such a "call" is an "act of observing" the already prepared state $S_z = 1/2$ in our "quantum device", with each subsequent "call" of this state, we can get both state $S_z = 1/2$ and another state $S_z = -1/2$, which corresponds to 0, and not 1. That is, it will be impossible to control what specific mathematical operation "our quantum computer" will perform when executing our command. When we try to calculate the sum (2+3) with our "quantum computer", not only will the sum answer be a random variable, but the results of calling the numbers 2 and 3 and the symbol "+" will be random output events. From the above, we can conclude that the "information bit" generated by the "quantum transistor" will work according to the principle of "quantum randomness", and the operation of the "quantum computer" will also depend on "how God throws the dice in different cases of challenge". The result will be a "computer for itself," and if we try to use it, the "computer for us" will act like a "virus-infected computer," producing a variety of different responses. We will never be able to verify the "correct result" obtained by this "infected computer" through repeated calls or calculations on other similar "computers for us".

This quantum "Virus"—corresponding to the "Observer Factor," in honor of the "Q-bit"—can be conventionally called the "Q-virus."

In some publications related to this topic (see, e.g., [7], [8], [9]), such a mechanism of "quantum computing" is indeed discussed, called "purely one-qubit deterministic quantum computing - (DQC1)". In this method

of calculation, the "phenomenon of probabilistic results" is introduced for individual acts of calculations, and the final deterministic result of the calculation is the result that most often appears in the large statistics of repeated calculations. A detailed discussion of this part of the quantum myth would unnecessarily expand the scope of our analysis, and at the same time, would not add anything new to the arguments considered in favor of a quantum computer for us. Therefore, we will not conduct such an analysis.

As noted in the previous subsection, if the physical state – corresponding $S_z = 1/2$ – has properties implied in [5] and [6], then these states will be stable with respect to our "challenges" and the results of the "challenges" will become deterministic. However, as we have already said, if experiments show that spin characteristics really do have such a "large inertial property" in relation to acts of macroscopic observation (i.e., to "calls"), then this characteristic, together with the object that carries it, must be transferred from quantum mechanics to classical mechanics, and computers built with their help will not be "quantum". In this case, our "quantum device" will cease to be a "Q-bit", since there will no longer be state vectors, the "superposition" of which was supposed to form the basis for the creation of the "Q-bit".

We will discuss this issue in more detail in the next part of the text.

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