Rendition of reality.
Exploration and contemplations.

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Abstract

The questions of reality have always followed mankind, at least, throughout the last two centuries. Does reality actually exist or is it just a simulation of a higher form of life? Are we alone in the universe? Is there any way to travel from one period of time to another? Does time have a certain direction? Could parallel worlds actually exist? This paper tries to answer these and more based on the thematic questions. I also analyze and reckon other paradoxes of the quantum world. My reflections and some sort of proof are mostly based on quantum physics and philosophical ways of thinking. From the very beginning, I would also like to emphasize the importance of the fact that a considerable part of the musings is only probabilistic, due to the current inability of mankind to prove such kinds of things.

Chapter 1: The direction of time

Have you ever wondered in which direction time goes? Before proving the constancy of the speed of light for absolutely all observers, the passage of time was considered the same for everyone, namely, that each event happened in chronological order and had a certain number in time, the notion of which would be the same in calculating an interval between occurred events. Nevertheless, this point of view was abandoned after Einstein's publication of his Theory of Relativity. Scientists and philosophers now have diverse convictions, however the fact that the passage of time depends on every individual separately and is not the same for everyone is undeniable. It can be easily proven by truly effortless contemplations, mostly based on relative understandings of each person's reality:

Imagine a person walking down the street with his clocks showing him 11 a.m., somewhere in New York, and another one, in London, driving home by car. The first one is, for instance, late for a meeting with some friends, nonetheless, the second one is getting home after an exhausting day at work. The difference is not so sophisticated to find: The passage of time has never been the same for anyone, not being connected with each other by any factors, correspondingly, it has always been, and will surely be, more of a subjective notion.

This assertion, however, may be modified and alternated by bringing some sort of determinants in:

Now imagine a pile of students sitting in a class. The duration of a lesson is, for example, 45 minutes. Considering all of their time determinants as absolutely correct and the same, a suggestion of their time proceeding being entirely identical can be made. In the process of a certain number of them checking the passage, the time would be equal for everyone. In other words, student A cannot think of 25 minutes being traversed from the beginning of the lesson, while student B, checking totally the same clock, speculating 40 minutes.

These statements are quite obvious to achieve, nevertheless, are depicting personal understandings of time of each person in the best way and may facilitate subsequent thoughts on the topic of the direction of time.

Now let’s move on to the understanding of its direction:

The laws of physics describing the most diverse phenomena of nature, from the motion of bodies to the behavior of an electric charge, have time invariance (they are T-symmetric). In other words, if we mentally reverse the time axis, all the formulas and equations of classical and quantum mechanics, electrodynamics and Relativity Theory will still be observed, unless some quantities change their sign to the opposite.

It would seem that every branch of physics does not care in which direction time flows, except thermodynamics, one of the principles of which postulates: the entropy of an isolated system cannot decrease. This is perfectly consistent with our everyday experience: chaos is growing. Time flows only in one direction, and hardly any of the people have ever observed how heat is transferred from the refrigerator to a bottle of warm water placed in it, heating it, or how a broken glass is folded back into a whole one. Why are the other physical laws so "indifferent" to where the time of the processes they describe flows?

This complex paradox was described at the end of the XIX century. Johann Loshmidt, and other scientists since then have been offering different ways to solve it. A theoretical physicist, Lorenzo Maccone, recently came up with his own and quite interesting solution.

With the help of ingenious calculations based on the formulas of quantum mechanics, Maccone showed that entropy can not only increase or remain constant, but also decrease; however, in this case the process will leave absolutely no information about itself. Accordingly, for any outside observer, and for the rest of the universe, there is no such process at all. In other words, Maccone reduced the Second principle of thermodynamics to a rather paradoxical statement that, in principle, we are not able to fix or study cases when entropy decreases, except "on paper", since there is no information about them.

To illustrate his point, he proposed such a thought experiment. Imagine that A sends B data by a separate particle. B can comprehend this information, for example, by measuring the spin of the resulting particle, while destroying the uncertainty of its quantum state. In the B system, entropy will increase, but in the A — B system it will not change.

In order to reduce entropy and return everything to its original position, A will need to return the uncertainty to the particle — including the destruction of the information B read, notebooks where she made notes about the measurement results, and so on. In the A — B system, entropy, again, will remain the same, but in the B system it will decrease. At the same time, no information about this event will remain within the B system — after all, this was one of the conditions of the task facing A.

Now imagine that the Universe acts as B. In this case, with the participation of some speculative A, those events may occur that lead to a decrease in entropy — however, neither we, nor the Universe, will notice this. Such an idea allows us to resolve the paradox with the reversibility of the time axis: now nothing prevents it from flowing in one direction or another (without contradicting the "T-symmetric" laws of physics), only the reverse flow in principle cannot be observed (in accordance with the "T-asymmetric" laws of thermodynamics).

My contemplations about time may help us to reflect on more grandiose ideas, which I am going to write about in the following chapters.

Chapter 2: Relative concepts of reality.

The situation here is nearly the same as the circumstances for time. Reality is completely subjective and is not the same for everyone. Moreover, the reality of each is utterly correct and it turned out that there is no room for unity when it comes to the understanding of the reality concept. It can be easily shown on an uncomplicated mental experiment or a paradox, firstly interpretated by Eugene Wigner:

He slightly complicated Erwin Schrodinger's experiment with a cat, by adding a category of friends to it. According to the paradox of Wigner's friend, imagine that after completing the experiment with Schrodinger's cat, the experimenter opens the box and sees an alive cat. The vector of the animal's state at the moment of opening the box goes into the state "the core has not disintegrated; the cat is alive". Thus, it is recognized alive in the laboratory.

But there is a friend outside the lab. He does not know whether the cat is alive or not, and recognizes the cat alive only when the experimenter informs him of the outcome of the experiment. But all the other friends have not recognized the cat alive and will accept it only when they are told about it. Thus, a cat can be recognized as fully alive only when absolutely every living person, in the universe, acknowledges the result of the experiment. Up to this point, the cat remains in a superposition of two states — between life and death.

This scenario has been an interesting thought experiment for a long time. But does it reflect reality? From a scientific point of view, progress in this direction was insignificant until recently, when Chaslav Bruckner from the University of Vienna showed that, under certain assumptions, Wigner's idea can be used to formally prove that measurements in quantum mechanics are subjective for observers.

Bruckner proposed a way to test this notion by translating Wigner's friend's paradox into a framework first established by physicist John Bell in 1964. Bruckner considered two pairs of Wigners and their friends who were in two separate rooms and taking measurements: the Wigners were inside, and the friends were waiting and guessing outside. The measurement results of each pair can be summarized to finally solve Bell's inequality. If it breaks, observers may have different measurement results, each of which will be correct.

Now physicists have conducted this thought experiment in the real world for the first time. To do this, they used a quantum computer and three pairs of entangled photons. The first pair represents coins, and the other two are used for their "tossing" — measuring polarization. At the same time, each "coin" is in its own closed vessel, where, in addition to it, there is a "throwing" photon. On the outside of these two boxes there are two more photons that perform the function of "observer friends".

Despite using state-of-the-art quantum technology, it took scientists weeks to collect enough data from six photons. In the end, they showed that Bell's inequality is violated, therefore, each of the observers of the quantum phenomenon can have their own alternative facts. This means that there cannot be "one truth" for the quantum world: measurements from different positions will give different results and will be equally true.

Now I am going to talk about something, which may seem utterly insane, nevertheless, could somehow be true. It has nearly nothing to do with equations, physics, mechanics and that sort of branches, but only philosophy. As I mentioned in the abstract, our life and the reality itself could be just a simulation, moreover, a nonsense (for us) simulation by a higher form of life. So how could we know if it is actually true? Being honest, this theme is incredibly sophisticated to talk about. I am not effectively a proponent of this theory at all, however the idea of it is entirely fascinating and enthralling.

There is no such evidence, that would leave us totally questionless on the possibility that the reality is simulated. That is why it is worth stepping back and asking the same, but a little bit modified question: what if reality is simulated? This is where our mind can shine with multiple ideas.

If reality is actually simulated, what kind of meaning of life could there be? A person might find it for him or herself, however all of their beliefs, hopes and dreams would never be truthful. It would make most people's concerns, expectations and anticipations completely nonsense. Humanity commits cruel experiments and explorations, however might itself be a huge experiment. If a person is asking himself about the reason of it and saying some sort of things, such as calling this experiment atrocious and monstrous, then he should look at things he does: eternal trials over the lower forms of life on earth, especially during the last two – three centuries, and declarations of self-sufficiency and self-perfection. Where has a human reached and who does he think he is, not knowing anything about the truth?

This contemplation could have a whole essay written about it, but that’s not the point right now. What actually matters is the logical question, being articulated subsequently after the thoughts: why would anyone even need such an experiment to subsist? The answer is probably apparent and can be fully displayed in our experience. In order to achieve certain breakthroughs in any chosen aspect of science, there is likely an experiment to be held. Experiment has always been the best way of proving contemplations and likewise discovering something new. Again, I don’t consider myself a supporter of such a theory, however we may just be toys in hands of a real civilization, which is a bit sorrowful.

However, there is always the other side. In this situation, the achievements we make are not senseless, as it would seem at a glance. If the theory is true, then, eventually, the whole existence of us would be meaningless. Nevertheless, it is always better to live in the moment, isn't it? The whole history is behind us. Mankind has been through an innumerable number of things throughout its beingness. Therefore, we have accomplished inconceivable successes, which are currently providing an opportunity to live the best life ever possible. Exactly because of this, I would never believe or even care about this theory.

Then what is reality? It is not a concept which might be thought about from only one perspective. The meaning of it is completely subjective and can be found by each person’s own reflections.

Chapter 3: The probability of time travelling.

The easiest task for a time traveler is to get into the future. In such stories, you cannot even think about how the time flow is arranged: since the future does not affect our time, the plot will almost not differ from a flight to another planet. In a sense, we all travel through time anyway — at the rate of one second per second. The only question is how to increase this speed.

Einstein's theory of relativity makes it possible to compress and stretch time at near-light speeds, which they enjoy using in fiction. The famous "gemini paradox" says that if you rush around space for a long time at near-light speed, a couple of centuries will pass in a year or two of such flights on Earth.

Moreover, the mathematician Geodel proposed a solution for Einstein's equations in which time loops can occur in the universe — something like portals between different times. This was used in some films, like "Interstellar", first showing the difference in the passage of time near the event horizon of a black hole, and then throwing a bridge into the past using a "wormhole". But is it possible to travel from one period of time to another using such a method? To Be honest, I'm not really sure, neither do scientists. But my paper, as I said, is based on probabilistic contemplations, therefore, our reasoning power is not limited by any distractions.

One of the main problems of time travelling, exactly to the past, is obviously the principle of causality. Sending anything back in time, even a message, would violate a fundamental law of nature: the principle of causality. Even the most run — down prophecy is already, in a sense, time travel! All the scientific principles known to us are based on the fact that an event occurs first, and then it has consequences. If the effect is ahead of the cause, it breaks the laws of physics. But how can we deal with this problem?

It can be stated that time is a single and indivisible stream: a thread is stretched between the past and the future, along which you can move.

It is in this picture of the world that the most famous loops and paradoxes arise: for example, if you kill your grandfather in the past, you can disappear from the universe. Paradoxes appear due to the fact that this concept (philosophers call it "B-theory") claims that the past, present and future are as real and unchangeable as the three dimensions we are familiar with. The future is still unknown — but sooner or later we will see the only version of events that should happen.

It can be worse: in more "flexible" worlds, a careless act of a traveler can lead to a "butterfly effect". Interference in the past rewrites the entire time stream at once — and the world does not just change, but completely forgets that it has changed. Usually only the traveler himself remembers that everything was different before. In general, single—threaded time is a confusing and hopeless thing. Many scientists and thinkers decide not to limit themselves and resort to the help of parallel worlds. And that is where the bifurcation of time comes in.

This concept not only allows you to get rid of contradictions, but also captures the imagination. In such a world, everything is possible: every second it is divided into an infinite number of reflections similar to each other, differing in a couple of little things. The time traveler doesn't really change anything, but only jumps between different facets of the multiverse. In such a theory, no paradoxes arise, due to the fact that if there is an infinite number of realities, then an infinite number of scenarios also do exist.

Another interesting theory occurs when people abandon the "B-theory" and decide that there is no fixed future. Maybe unknown and uncertainty are the normal state of time? In such a picture of the world, specific events occur only in those segments where there are observers, and the remaining moments are just a probability.

And the last thing I'd actually like to talk about are the aftermath being originated subsequently after theoretically admitting the fact of time travelling. What if time travelers do exist? Let's make an assumption that a person travels from 1920 to 2023. However, in our reality it is the year 2023 and it just logically cannot be the 20th century. However, we are going from the conjecture that such a move from that time to ours has happened. Thereafter, another reality in which it is 1920 must exist. This contemplation nearly proves the existence of parallel worlds, however is giving birth to many other questions, such as "How do they exist?", "Does the history and chronological sequence of events move exactly the same as ours?". I will surely try to find answers to these issues in the future.