

Many-world Interpretation: Quantum Suicide and Quantum Immortality

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The mesmerizing world of quantum physics, as described by Erwin Schrödinger himself, is “quite ridiculous.” There has always been an argument regarding the quantum states in which a quantum particle exists. This argument led to the formulation of two interpretations in quantum physics- the Copenhagen interpretation and the Many-World interpretation. These two interpretations contradict each-other in their ways of explaining the existential states of a particle in the quantum world.

The Copenhagen interpretation is the more popular interpretation among these two, the reason being the famous thought experiment given by Erwin Schrödinger, which is known as Schrödinger’s Cat. This interpretation says that a quantum particle exists in all the possible quantum states, until and unless it is observed in some specific conditions. As soon as it is observed, it gets confined to only one quantum state, based on the conditions.

To explain this interpretation, we have the Schrödinger’s Cat. This is a famous thought experiment, i.e. which cannot be performed in reality, but only in one’s mind. To describe briefly, this experiment consists of a cat, a bottle of hydrocyanic acid-which is very poisonous, a hammer, a bit of radioactive material and a Geiger-counter. If the radioactive material decays, then the Geiger-counter will click, and it will trigger the hammer to break the bottle of poison, thus killing the cat. But if the material doesn’t decay, then the cat will live. Now let us put all these equipment inside a closed box. Now, until and unless we open the box and observe the cat, we would never know if the cat is dead or alive. So, if we bring in the Copenhagen interpretation, it will say that the cat is now in a superposition of both the states- dead and alive! Thus, Schrödinger’s cat is dead and alive at the same time, until and unless we observe it.

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Thus we see that the Copenhagen interpretation gives priority to the observer while explaining the state of a quantum particle.

But there is another interpretation of quantum physics, in which the particle and its state and not the observer gets so much priority that the universe itself considers splitting into two in order to accommodate the quantum states! Yes, this interpretation is known as the Many-world interpretation.

This interpretation was first proposed by Hugh Everett, a research scholar in Princeton University, in the year 1957. According to this interpretation, for every possible outcome of the observation of the quantum states of a particle, the world i.e. the universe splits into some “multiverses” or “parallel universes”. One of them accommodates the state in which we observe the particle, and the others accommodate the other different states that could have been taken as some other possible outcomes of the observation.

Let us take a simple example. Suppose in this universe a person has been asked a question: “Do you like

chocolate?” Now, there are two possible outcomes of this observation: yes, the person likes chocolate; and no, the person doesn't like chocolate. Now, if the person answers “yes”, then according to the many-world interpretation, the universe will split into two parallel universes. In one of them, the person likes chocolate, and in the other one, the person doesn't like it.

Thus, this theory indicates that for every individual observation since the beginning of time, there have been trillions of parallel universes with at least one difference in states of existence of at least one particle! Even the imagination makes the head go dizzy, isn't it?

This splitting of the universe also causes the splitting of the time axis as well! The two parallel universes make the time axis split into two branches, each accommodating one of the parallel universes. Thus, it is clear that for each and every individual observation of states, there must be billions and billions of sub-branches in the time axis! And if this was not intimidating enough, here is another fact: we are yet to find out a way of transportation between these branches in the time axis. But what if one day we actually find out a way? The consequences are way more fearsome! Imagine finding your own self in front of you and arguing with him/her about a particular choice!

With this mind-boggling theory came another mind-boggling thought experiment in 1997, proposed by Max Tegmark, who is now a faculty in MIT. This experiment is known as Quantum Suicide. The experiment is as follows:

A man wants to commit suicide. He is sitting down in front of a gun inside a box. The gun is loaded with only one bullet. The gun is connected to a mechanism which detects the spin of an electron. If the electron spins clockwise then the gun will fire. But if the electron spins anticlockwise then the gun will not fire.

Now, the mechanism is switched on. The electron spins clockwise, suppose. Then the gun fires the bullet. And the man is successful in his suicide.

But, according to the many-world interpretation, as soon as the electron spins clockwise, the universe splits into two, and in one of them, the electron spins anticlockwise. Thus, the person is alive in that parallel universe.

Now, the electron spins again in that universe. Again the process repeats. The parallel universe also splits into two. In one of them the man is dead, and in the other one, the man is alive.

In the universe in which the man is alive, the process is repeated for an infinite number of times, and the man still remains alive through a network of split universes through the branches of the time axis that were created each time the electron spin was measured. Thus, in a way, the man achieves immortality, or more precisely, Quantum Immortality!

This thought experiment of quantum suicide is certainly more intriguing than the commonly known Schrödinger's cat experiment. This is a perfect example of the ideas which come out of the many-world interpretation of quantum physics.

The splitting of the universe, according to this theory, is instantaneous and happens without the

knowledge of the observer. Thus, it is in stark contrast with the Copenhagen interpretation in which the observer gets the priority of confining a quantum particle or system into some specific state. In the many-world interpretation, the universe itself “bows to” the quantum system!

But when we consider some possible consequences of such vigorous splitting of the universes, we can clearly see the chaos that would have resulted due to this. Because, if this many-world interpretation is true, then in some parallel universe, Adolf Hitler won the World War II. And in some other universe, World War II did not even happen!

Now the question is: if this interpretation is true, then will mankind ever be able to find a way to transport between these branches of the time axis? Will we ever be able to move between the parallel universes and meet our “second selves” from those universes? And, what kind of chaos would it lead to? It is also possible to find a second self of one who is exactly opposite to the one. This second self can be called the “anti” version of that person. So, what would happen if ever the person and the anti-person come face to face?

Thus, this unusually intriguing interpretation in quantum physics provides us enough food for thought. Although this interpretation sounds more ridiculous than the Copenhagen interpretation, still it has been one of the most interesting theories to ponder over. Hopefully, one day we will be able to find out the truth about these interpretations. Until then, quantum physics will continue to amaze us, baffle us and puzzle us in all the possible ways! As Niels Bohr himself once said, "Anyone who is not shocked by quantum theory has not understood it."

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