Explaining Quantum Entanglement with Modified Born Probability Interpretation

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Abstract

This paper briefly explains quantum entanglement using a modified stochastic analysis. According to the modified probability interpretation, quantum entanglement does not violate locality and reality. Wavefunctions can also create, preserve, or delete information.

1. Introduction

The EPR paradox proposes a way to find out physical quantities without making observations. According to the EPR paradox, quantum entanglement is nonlocal, and there are hidden variables that physicists do not yet know, and it is argued that the state is already determined before measurement according to the hidden variables. [1] The EPR paradox was devised to show the incompleteness of quantum mechanics, but the theory of hidden variables was proven incorrect by Bell's theorem and quantum entanglement experiments. [2] But does Bell's theorem really violate locality and reality? If quantum entanglement is nonlocal, information travels faster than the speed of light, and if quantum mechanics violates reality, then the unobserved should not exist. Bell's theorem and the quantum entanglement experiment can show that quantum mechanics is sufficiently valid, but it does not completely solve the question of reality and locality. So, what is needed to resolve the yet unresolved questions of reality and locality?

My previous papers 'Modification of the Born Probability Interpretation'[3] and 'Explanation of the Double-slit Experiment with a Modified Probability Interpretation'[4] provide a solution to the locality and reality raised in the EPR paradox. The most desirable conclusion in quantum mechanics is to show that superposition and quantum entanglement are correct without violating locality and reality. In addition, this interpretation and verification process will be a process of supplementing the incompleteness of quantum mechanics. Therefore, in this paper, first, by explaining quantum entanglement through a modified probability interpretation, we will confirm that quantum mechanics does not violate locality and reality.

2. Dark matter and the question of the reality of the wave function

According to the modified probability Interpretation, particles with too high a threshold or infinity threshold are difficult or impossible to observe. Particles that are difficult or impossible to observe like this are called dark matter. So, is unobserved dark matter not real? An objection to this question might be that dark matter is real because it exerts a gravitational pull on the macroscopic world. But it's the same for other substances? If matter exerts a gravitational force on another object, then matter must be real. But when we consider quantum mechanics experiments, it doesn't matter if we don't consider gravity. Even in an environment where gravity exists, the quantum double slit experiment shows the characteristics of superposition and the observation effect as it is. The same should apply to dark matter. According to the Copenhagen interpretation, even if dark matter exerts gravitational force, it should not be real unless it is observed. However, this is strange because something that is not real is acting on gravity. So how should we think about the reality of dark matter and the wave function? The answer is simple. Dark matter and wave functions are real regardless of observations. Rather, the threshold determines whether an object is observable or not. Ordinary matter is easily observed because the threshold is moderate, but dark matter is not observed because the threshold is too high or has an infinite value. Observations affect the state, but the wavefunction collapses not because of the observation, but because the wavefunction's amplitude reaches a threshold.

Then, what is the difference between dark matter and matter, so that it has a high threshold and is not observable? A leading guess for this is that dark matter is predominantly non-quantized. In other words, dark matter can be assumed to be mostly non-vibrating. Basically, things that vibrate easily reach the threshold because they are quantized, but things that are not quantized cannot reach the threshold. Not vibrating means that the wave function is 0, and having this property is closer to the property of space than matter. For example, three-dimensional space does not collapse well because the threshold value is very high or has an infinite value. However, under extreme conditions, such as black holes, even three-dimensional space can collapse. Dark matter does not decay easily unless under extreme conditions, and observation is impossible unless dark matter decays. Dark matter is more like space than matter, and because space has mass, it creates gravity. However, as we know, three-dimensional space does not have mass. Therefore, a more special condition is needed, and that condition would mean a high-dimensional space. In another way, high-dimensional space can be said to have multiple dimensions, including mass, in which vibrations cancel each other out. The collapse of 3-dimensional space can create matter and high-dimensional space. The collapse of 3-dimensional space can create matter and high-dimensional space. Conversely, a high-dimensional space can collapse to create a 3-dimensional space or material. The reason why quantum fluctuations are possible in empty space is because spaces collapse and change into matter and then return to space. And in these decay processes, a singularity always occurs. Because the singularity meets extreme conditions, it can cause collapse even in spaces with high thresholds. Dark matter is a very, very small high-dimensional space. Ordinary matter, on the other hand, is quantized and vibrates.

3. Explaining Quantum Entanglement

What does it mean for the wave function to be real? That is, information actually exists overlapping. Whether observed or not is irrelevant. A wavefunction is a superposition of several possible states before it collapses. In this case, the possible states also contain information about speed. Because wavefunctions do exist and are superimposed, they conform to the principle of locality. In addition, since the wave function has time flow symmetry, it is meaningless to distinguish between the past and the future, and the state of the wave function has already been determined in all possible states. In modified probability interpretation, the wavefunction moves from the start point to the end point and back again from the end point to the start point, and so on. This allows the wavefunction to maintain a superposition of various states. This process is also a process that moves according to the principle of locality. The wavefunction itself is a result of the principle of locality. Quantum entanglement seemingly transfers information at a speed faster than light over a long distance, but in fact, information is already transferred based on locality.

For example, let's say we send two particles in a state of quantum entanglement far away and observe them. Here, the two particles have two superposition states, up spin, and down spin. But at the same time, both particles also have information about their velocities. If these two particles are photons, they are traveling at the speed of light and have superimposed up spins and down spins. And when the two particles reach the threshold, the wave function collapses, selecting only one of the information it has and discarding the rest. Since the two particles travel at the speed of light, the principle of locality is not violated. In fact, two particles in a state of quantum entanglement have all possible information from the starting point. An entangled state means that systems such as particles have the same starting point. Particles in the entangled state have time-flow symmetry and remain superposed. To stably maintain the entangled state, it is important to prevent reaching the threshold as much as possible and to keep the same starting point. For example, the act of moving two particles in a quantum entangled state into a perfectly block able box will make the entanglement easier to break. This is because the wavefunction must be able to return to the starting point for the particles to prevent the collapse of the wavefunction and keep the entanglement stable.

Observation makes it easier for the wavefunction to reach a threshold and makes it impossible to return to the starting point by collapsing the wavefunction. Observation makes it easy for the wavefunction to reach a threshold and makes it impossible to return to the starting point by collapsing the wavefunction. A collapse of the wavefunction can occur even in the absence of observations if a threshold is reached. When the wave function collapses after two particles in a quantum entangled state move away from each other, only one piece of information in the entangled state is preserved and the rest of the information is deleted. Therefore, the principle of locality is not violated, and there is no problem with reality. In addition, since a singularity occurs when the wavefunction collapses, the two particles are connected to each other through the singularity, and after a high-dimensional space is created, the connection is broken and the entanglement state is completely broken, and new wavefunctions are created at the observation point. Then, when the high-dimensional space collapses, the wave functions spread out again.

4. Conclusion

If there is a hidden variable in quantum mechanics, it would be the threshold. However, the presence of hidden variables does not support determinism. Quantum mechanics is still indeterministic. This paper explains quantum entanglement using a modified probability interpretation and complements the Copenhagen interpretation. Experimental results of quantum entanglement should agree with the Copenhagen interpretation, but problems of locality and reality have made quantum mechanics completely inseparable from philosophical problems. This thesis shows that quantum entanglement does not violate reality and locality, which allows quantum mechanics to be completely freed from philosophical problems. Quantum entanglement is a phenomenon with both reality and locality and is a phenomenon in which various information is preserved through the overlapping of states and the rest of the information except for one entangled state is deleted through the collapse of the wave function. That is, wavefunctions can create and preserve or delete information.

5. Reference

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