

If the Wave Function Collapse absolutely in the Interaction, how can the Weird Nature of Particles are Born in the Interaction? —A Discussion on Quantum Entanglement Experiments

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Abstract

Objectives: Particles can re-exhibit volatility after their wave function (or wave packet) collapses (proven by experiments such as secondary electron diffraction experiments). Is the volatility recovered or does the collapse process not destroy the volatility or is the collapse process not there at all? After the wave function (or wave packet) of a particle collapses, the superposition state should not exist. **Methods:** If the wave function can be collapsed by measurement and the quantum characteristics cannot be recovered after the collapse, then the microscopic particles that reach the free motion state through interaction can no longer have the quantum characteristics of quantum parallelism, Quantum Entanglement (QEM) or quantum state superposition. **Findings:** Restricted by the conditions in this conditional adverbial clause, logically, it is impossible to find Quantum Entanglement State (QEMS) by experiment (recognizing that the quantum superposition state is a non-real state, it is recognized that the state is unobservable). Under the assumption that entangled states (or superposition states) exist and that measurement can destroy entangled states, the related experimental phenomena are interpreted as QEMS. **Application:** This is clearly a logical cycle. Experiments show that the non-projective measurement cannot eliminate the diffraction effect of electron rays.

Keywords: Logical Cycle, Quantum Entanglement, Quantum Mechanics, Quantum Non-Locality, Wave Function Collapse

1. Introduction

In¹ published an article in Nature, saying that they used the diamond color entanglement to complete the flawless Bell inequality verification experiment. The data for this experiment was not enough and the confidence was not enough (2.1 standard deviation). In addition, there is a very contradictory statement. The title says no loopholes, but the text mentions that no Bell experiment can rule out all local realism. This is actually a true conclusion that

contradicts the title: The argument in the title is false and this conclusion contained in the text is true. Why do people only believe in the title of the article and not believe in the true conclusions contained in the article? This only shows that people's prejudice is very serious. Another strange thing is that¹ said in the article that it is easy to increase the confidence of the data. However, more than three years have passed, but no subsequent experimental results have been seen. It can be seen that the loopholes in the Bell Inequality Verification Experiment are diffi-

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cult to block. For the verification of Bell's inequality, it is technically difficult to achieve no loopholes and perhaps it is due to the irremovable loopholes in theoretical logic. It is still necessary to discuss the verification and logical thinking of Bell inequality. I just want to point out the logical fast-knot of Bell's inequality (and the logical fast-knot of the QEM concept that is closely related to it). This work has not been done before.

The measurement process is a process of interaction. The generation and liberalization of micro-particles are inseparable from interaction. On the premise that the measurement can lead to the disappearance of quantum properties, the quantum properties of microscopic particles cannot be formed at the time of their birth. For experimental facts, existing orthodox quantum mechanics need this view: As long as the microscopic particles can move away from the original owner and move freely they can resume their volatility (or, as long as a particle moves freely from its original owner, it has wave-particle duality)^{2,3}. Along this line of thought, a question new will appear. When microscopic particles change from non-free motion to free motion, can quantum characteristics such as quantum parallelism and QEM be restored? I will also discuss this issue in this article.

Under the premise that the measurement must lead to the disappearance of quantum weirdness, if all processes of interaction belong to the measurement process, then quantum's strange properties are impossible to form and can only be restored when they become free moving particles. This recovery process is the reverse process of the wave function collapse (or wave packet collapse). In other words, if the measurement (observation) must cause the superposition state (wave packet or wave function) to collapse, the experimental method (i.e., observation) cannot be used to prove that the Schrodinger cat state exists. Quantum mechanics scientists believe that quantum superposition states are non-real states. Non-real state also cannot be found by experiment. These are all logical difficulties to prove the existence of Schrodinger's cat state in quantum mechanics by experimental methods. This is also an insurmountable contradiction in the existing

quantum theory. The experimental fact is that particles that are detached from the instrument by interaction have a range of quantum characteristics. If the quantum characteristics that have collapsed cannot be recovered, then the quantum's strange properties (including quantum superposition state) should not exist.

The existence of the above problems indicates that it is claimed that the QEMS has been observed and it is highly probable that it is fraudulent (unless it is always recognized that the non-real state such as the quantum superposition state does not exist). However, unfortunately, the experimental interpretation of the existence of QEM must rely on the two hypotheses: 1. The quantum states between conjugated particles must be superimposed (i.e. entangled, quantum is non-local); 2. The superimposed quantum state will collapse when the wave function is observed (measured) (i.e., any measurement will change the superimposed quantum state). The interpretation of QEM experimental phenomena is a circular argument (the starting point or the premise is that the superposition state and the entangled state exist and the end point or the introduction is still the existence of entangled state).

Bell's inequality or CHSH inequality is derived from the assumption the role of the implicit parameter of the local realism exists. The notion that implicit parameters work is the concept of local realism. It can be seen that the assumption of deriving Bell's inequality or CHSH inequality is contradictory to the two hypotheses (both superposition states and QEMS are not localized real states)⁴. The interpretation of experimental phenomena for verifying Bell's inequality or CHSH inequality is precisely based on that the hypotheses are established. Therefore, the experimental phenomenon of verifying Bell's inequality confirms that the premise used in establishing Bell's inequality contradicts the experimental criterion. Using experimental methods to verify QEM requires the application of Bell's inequality. However, judging whether the Bell's inequality is established or not requires QEM to exist beforehand (the phenomenon needs to be interpreted as non-localized association). This is also a circular argument. It is easy to see that the Bell inequality and its

verification experiments have no positive significance. The experiment of verifying Bell's inequality can neither confirm that the prediction of quantum mechanics is correct, nor can it prove that Einstein's principle of locality is wrong. In this paper, the weird properties (or strange or singularity characteristics) of particles means the quantum characteristics: Volatility, quantum parallelism, quantum state superposition, QEM, non-reality and non-locality or one or several of them.

2. Methods and Materials

The method used in this paper is based on phenomena analysis and logic analysis, supplemented by one experiment. The experimental materials were an electron diffractometer, a permanent magnet and an alternator.

2.1 The fact that the Microscopic Particle Diffraction Experiment shows that the inference that Measurement will definitely cause the Wave Function to Collapse is Incorrect

Wave function has wavelength, frequency and amplitude. The observed diffraction phenomena of microscopic particles are determined by the properties of wave functions. If the wave function (or wave packet) collapses, the diffraction phenomenon will not be observed. If we believe that as long as the measurement, the wave function will collapse, we should believe that the particle beam whose wave function (or wave packet) collapses can no longer form a diffraction pattern. That is to say, as long as the wave function of the microscopic particles collapses, diffraction cannot occur. Diffraction can still occur after the particles are measured, indicating that the measurement has not cause the wave function (or wave packet) to collapse. Be aware that letting the particle beam pass through the slit is that the particles are measured (the instrument exerts an influence on the particle beam as the particles pass through the slit). The effect of the slit on the particles beam is much greater than the effect of purely measuring consciousness on the microscopic particles! There are many orthodox quantum mechanics who believe that

measurement consciousness can also affect the behavior of microscopic particles, and thus have to use subjective intervention concepts.

The fact that the secondary diffraction experiment of electrons can show that the measurement cannot cause the wave function to collapse more clearly than the fact of single-slit electron diffraction experiments. If using a slit to measure particles, the slit must cause the wave function of the particle to collapse. The second diffraction cannot occur. The double-slit diffraction can still occur from the particles coming out of the cyclotron. This fact indicates that if the measurement must cause the wave function to collapse, the weird characteristics of the particles must be restored when they return to freedom (otherwise, the weird properties of particles can only be born in interactions). If the collapse can only happen on the screen, the results of the electron diffraction experiment in the magnetic field described in Section 2.3 can indicate the measurement using the magnetic field does not cause the wave function of the electron to collapse. In this way, hypothesis 2 does not hold.

Wave functions cannot be observed, it is a non-objective and non-reality. The superposition of wave functions is also a non-objective, unobservable and non-reality. It can only return to the reality state after the wave function collapses. This seriously deviates from the requirements of reality and objectivity in philosophy.

Considering the nature of the wave function in the existing orthodox quantum theory, it is not difficult to draw the following conclusions: Only that wave function (or wave packet) collapse process does not exist, quantum theory is more reasonable (the nature of the wave function can be re-recognized). The photo-junction particle structure model proposed in⁵ considers that the real wave is inside the particle. Therefore, when measuring the overall behavior of the particle, the wave and wave function cannot be detected. Under the premise that measurement can cause the wave function to collapse, it is not logical to think that weird quantum features are born in the measurement. Experimental facts also prove that the wave function generally does not disappear when passing through the slit and magnetic field space.

2.2 If the Measurement can lead to the Disappearance of Quantum Characteristics, Quantum Characteristics cannot be Produced in the Interaction

Existing orthodox quantum physicists believe that wave function (or wave packet) collapses as long as there is an interaction. However, few people have noticed that this interpretation has a serious contradiction caused by interpreting out of context (only consider the local experience of the particle without considering the full experience of the particle). In an electron microscope, the acceleration of electrons must be affected by a strong electric field and the collimation and focus of the electron beam must be affected by magnetic fields. If a measurement (including the effect of electromagnetic field) must cause the wave function to collapse and the volatility no longer appears, it cannot be amplified by the volatility of the electrons.

Let's see how the microscopic particles are formed! Microscopic particles are generally formed in interactions. Non-newly generated free particles are generally obtained by the influence of the electromagnetic field and are separated from the original owner. It can be said that all free particles come from the original interaction. This is also true. This fact can be used to show that the quantum coherence of microscopic particles also comes from interactions. The generation of the quantum characteristics of free particles is synchronized with the formation of free particles themselves.

All measurements are made by interaction. Any process in which interaction exists is a measurement process. Therefore, it can be said that the weirdness of microscopic particles (this paper focuses on non-locality) are also produced in the measurement process. One view that has become very popular is that any measurement will cause the weirdness of microscopic particles to disappear. In this way, the weirdness of microscopic particles is both produced in measurement (interaction) and disappear in measurement (interaction). It really makes people feel lost: Does measurement result in the disappearance of

quantum coherence or the generation of quantum coherence? In short, as long as the microscopic particles and their quantum characteristics are generated (or the previous experience of free particles), in the existing quantum mechanical interpretation system, the influence of the same measurement conditions on the generation and disappearance of quantum characteristics is contradictory. To avoid this contradiction, we must at least deny the existence of some quantum characteristics. The path integral quantization method can't do anything to solve this problem. This contradiction has a very significant impact on the interpretation of QEM experiments and the verification of Bell's inequality.

2.3 As long as the Wave Function (or Wave Packet) Collapses, the Weird Characteristics of Microscopic Particles should Disappear

Wave function (or wave packet) collapse (or quantum decoherence) contains the disappearance of quantum non-local features. Therefore, the title of this section also means that the experimental method can be used to prove that, after the wave function (or wave packet) collapses, quantum non-locality can be proved experimentally.

In 2017, I spent ¥30,000 yuan to buy a good electronic diffractometer and a small generator. Using this generator as a power source, I made an electron diffraction experiment of an applied magnetic field very autonomously. In one experiment, the instrument continued to work for two hours and the diffraction of the electron beam current lasted for two hours. The easily-flowing electrons that participated in the diffraction cycled many times in the current loop. The same electron usually participates in diffraction more than once (see Figures 1 and 2). It has also been found through experiments that diffraction is not caused by light, but is actually caused by electrons. This experiment also directly proves that easily flowing electrons in a small current loop can still be diffracted after being affected by metal atoms and a strong electric field for accelerating electrons and a magnetic field for collimation. The external magnetic field can deflect and

deform the diffraction pattern. This action is exactly the same as the deflection of the classic electron beam in the magnetic field. The deformation of the diffraction pattern can be explained by the deflection of the electron beam. This indicates that the electrons after passing through the slit and arriving at the screen are still localized classic particles rather than discrete waves. During the diffraction process of this experiment, the electron beam will also be deflected by the magnetic field. This situation is completely similar to that the electron beam in the cathode ray tube is deflected by the magnetic field. If we have to admit that the collapse process exists, the wave function (or wave packet) collapse does not happen on the screen, but it must occur before the electron reaches the screen. The diffraction characteristics are still maintained after collapse, indicating that the diffraction is independent of the wave function of the particles. The experimental results also show that non projection measurements do not affect the formation of diffraction fringes. Based on this, we can be sure that non projection measurements will not affect the formation of double-slit diffraction fringes. It can be seen that it can only be observed by projection measurement at most that as long as observation, the diffraction fringes disappeared (the diffraction fringes cannot form). As long as you observe, the diffraction fringes cannot form. It may also be a fabricated lie (at least not comprehensive).

If the wave function (or wave packet) collapses when the electron hits the screen, it can be said that the easily-flowing electrons in the wire recover the quantum non-locality when accelerated into a free electron beam. That is, the collapse of the wave function (or wave packet) is reversible. In other words, according to the fact that the same electron can participate in diffraction multiple times in the current loop, it can be known that: If the diffraction of electrons is a manifestation of its quantum characteristics, then the electrons that have collapsed on the screen after diffraction have started from the screen and passed through the current loop surrounded by the wires to reach the entrance of the slit again, the singularity characteristics of electrons are restored. The detailed analysis is as follows:

In the small current loop of an electron diffractometer connected in series, these easy-flowing electrons will continue to flow (when the electron diffractometer continues to operate). The free-flowing electrons frequently collide with metal atoms in the wire and are affected by strong electric fields and strong magnetic fields (the former is accelerated electrons and the latter is collimated the electron beam). After diffraction occurs, an electron hitting the screen was recognized by existing textbooks as collapsed to a point. After the electrons are slid off the screen and then passed through the wires and accelerated again into an electron beam and comes to the slit entrance again, is the electron wave function (or wave packet) collapsed or the reverse collapse of the electron wave function (or wave packet) occurs? The difficulty in answering this question is: If it is recognized that the wave function (or wave packet) collapses or continues to collapse during the process, it cannot be admitted that diffraction occurs later; if it is recognized that the quantum characteristics are recovered in the process, it must be acknowledged that the quantum characteristics can be recovered upon measurement. But the experimental fact is that electrons can still be diffracted after collision, acceleration and collimation (i.e. the diffraction properties of the electron are independent of its previous experience). If the wave functions (or wave packet) collapse process exists as long as there is an interaction, collapse will inevitably occur. This fact requires that the electron must complete the inverse process of the wave function (or wave packet) collapse in the process of investigation. This is in contradiction with the existing orthodox quantum theory. There are two ways to overcome this difficulty: One is to deny the non-locality of the particle and the collapse of the wave function (or wave packet collapse) and to deny the principle of state superposition; the other is to think that the electrons can restore its quantum characteristics when it moving in a vacuum (i.e. recognizing that the collapse process is reversible) and has nothing to do with the experience of electrons before they resume their free motion. The second way conflicts with the theory of the existing orthodox quantum mechanics that collapse of the wave function (or wave packet collapse) is irreversible

and that as long as there is interaction, the wave function (or wave packet) collapses. Obviously, the first way (considering that quantum characteristics such as quantum parallelism, quantum superposition states and quantum non-locality do not exist) can really overcome the above contradictions.

The above contradiction affects the interpretation of the experimental phenomenon about QEM experiments. The reason is that the interpretation of the experimental phenomenon about QEM affirms the concept that measurement (interaction) can lead to collapse of superposition states and this concept has the above contradiction: As long as the measurement will cause the wave function (or wave packet) to collapse, the non-locality of the particle cannot be born in the interaction. It is not difficult to find that any experiment claiming to be QEM cannot prove the existence of quantum non-locality (see reason section for details).

For an electron beam, as long as it can produce single slit diffraction, it can produce double slit diffraction. The interpretation of the experimental phenomenon of the double-slit diffraction uses the characteristic of quantum



Figure 1. Electron diffraction pattern shifted left in the magnetic field. The right side of the strip is a magnet whose surface magnetic field strength is 6000GS.

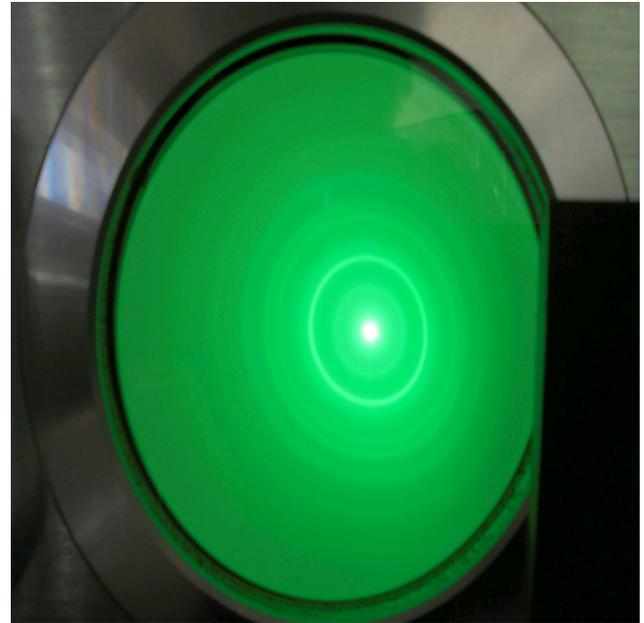


Figure 2. Electron diffraction pattern shifted right in the magnetic field. The direction of the magnetic field is opposite to the one of Figure 1.

parallelism. If recognize that the volatility of particles recovers in the process of being free from the original owner and becoming relatively free, it is acknowledged that the quantum characteristics of quantum parallelism recover in the process of the particles being separated from the original owner and becoming relatively free.

In summary, it is acknowledged that the wave function (or wave packet) collapse of incident electrons in an electron diffraction experiment occurs on a fluorescent screen and it is recognized that, the electron diffraction pattern is determined by the characteristics of the wave function of the electron and the addition of this section is introduced. The result of the electron diffraction experiment in an external magnetic field will show that the electron beam that has not undergone wave function (or wave packet) collapse can be deflected in the magnetic field, just as the electron beam in the cathode ray tube is deflected in the magnetic field. Measurements using magnetic fields do not result in a wave function of the microscopic particles to collapse.

2.4 The Current Interpretation of QEM Experiments requires the Assumption that there is Quantum non-locality and that Measurement can lead to the Disappearance of Quantum non-locality

The existence of QEMS needs to use QEM experiments to verify and the interpretation of the phenomenon of QEM experiments requires the assumption that QEMS exist. This is a kind of logical cycle. This indicates that the experimental verification of the QEM phenomenon is weak and weak. So that we can think of the QEM phenomenon is not true. We can even say that QEM is hypothetical. The existence of QEMS is an explanation of those experimental phenomena (and the reasons for this interpretation are very insufficient). How do we believe in the existence of QEMS? Why do we believe that QEMS exists? It is the wish of the theoretical workers that the quantum non-locality and the wave function (or wave packet) collapse during measurement. No one has proved that they are all real effects. However, the reality is that people believe in the existence of QEM (For decades, the non-locality of quantum has been so deeply rooted that it is very difficult to question). What an incredible thing it is!

After being observed, the wave function (or wave packet) collapsed and the quantum non-locality disappeared). That is, the measurement causes the non-observable superposition state to disappear. Assumption 1 is to assume the existence of QEMS. It can be seen that the so-called QEM come from a hypothesis. The reason is simple. If there is not assumption 1, you don't need assumption 2. Without any of these two assumptions, the related QEM experimental phenomena cannot be explained as the existence of QEMS. For sure, the assumption 1 is obviously a hypothesis about the existence of a QEMS. The premise is the existence of a QEMS and the conclusion also is the existence of QEM. Isn't this a typical circular argument (logic loop)? (Yes! this is a logical loophole about the interpretation of QEM experiments).

Assumption 2 also means measurement can cause the entangled state to disappear. Since the measurement must cause the entangled state to disappear, then we must not use experimental methods to find the entangled state. The existence of the entangled state before the measurement can only be inferred. This conjecture needs to exclude that the phenomena and states found by the measurements existed before the measurements. However, we can't rule this out experimentally. It is difficult for a rigorous-minded person to believe in the existence of QEM.

In interpreting QEM and quantum non-locality experiments (linking Bell's inequality and Leggett-Garg inequality with experimental phenomena, we get the data on the right side of these inequalities based on experimental phenomena), we must use the concept of that all particles must be in the quantum superposition state before being observed and will change the quantum state of the measured particle. Because these two concepts cannot be verified experimentally, thus, these two concepts can only be two assumptions or speculate. The experimental interpretation of the existing QEM and quantum non-locality can only be assumed. If the particles are really waves, there is only a possibility of superposition in mathematics, not necessarily superposition. It is also a kind of absurd speculation that a particle has two different quantum states simultaneously. There is no solid mathematical foundation for that the quantum state superposition must occur. This indicates that in the interpretation process of QEM experiments, speculation is more than empirical evidence. The description of the next natural section cannot be excluded.

An emission source emits a pair of electrons. In order to ensure conservation of the spin angular momentum, the spin directions of the two emitted electrons must be opposite. After the opposite direction of the spins of the electrons was detected, the result could not indicate that their spin directions were formed at the time of measurement rather than before the measurement when this pair of electrons spin in the opposite direction was detected. A light source emits a pair of conjugate photons. The electric vector of this pair of photons should also be con-

Table 1. The essential analysis of QEM

A	B	C	D	E
1	The prerequisite for the interpretation of QEM experiments	a, The spin state of the conjugated electron pair and the polarization state of the photon pair are both non-real uncertain states. Their explicit quantum states do not exist before the measurement.	b. The non-real uncertain states of two conjugated particles the is the quantum superposition state or QEMS.	c. When measuring, the function of measuring instrument will destroy the quantum superposition state. That is, measurement leads to quantum de-coherence or wave function collapse.
2	Have these prerequisites been verified by experiments?	No	No	No
3	Counter example and its consequences	As long as the counterexample of premise c exists, the experimental phenomena of QEM can be explained by that two conjugated particles have quantum states with opposite spins and the same polarization direction before measurement.	As long as the counterexample of premise c exists, the premise b is unnecessary.	Secondary electron diffraction experiment can deny that the measurement can lead to the collapse of wave packets (or wave function). The secondary electron diffraction experiment can prove at least that the collapse process is reversible.
4	The relationship between premise and experimental conclusion	Identical	Identical	----
5	Source	Hypothesis	State superposition principle	Hypothesis
6	The resulting (or existing) problem	Conjugated particles must not be mature or incomplete particles.	Unknown superposition mode	The collapse process is unknown (the collapse process is also assumed to eliminate the adverse effects caused by superposition).

served: At the same moment, the electron vector of one photon is radial and the vector of another photon must be down. That is, the polarization direction of these two

photons is the same (they vibrate up and down rather than left and right). It can be seen that the polarization direction of a pair of conjugate photons is also not formed

when measured but is formed before being measured (the explicit polarization directions are formed when they are born). Real and complete electrons must have a definite spin state. As long as we believe that any substance is real, we will not believe that the spin state of the electron is formed by measurement at the time of measurement. The same is true for the polarization of conjugate photon pairs. Only when we negate the reality of matter and with the contradictions pointed out above can we believe that QEM exists. A more intuitive analysis is shown in Table 1. Comparing the premise b in the 1D cell with the interpretation of the experiment phenomenon of QEM, it can be clearly seen that the premise is the same as the result. Without the premise b, the experiments verifying the Bell inequality cannot prove the existence of the QEMS. The a and b in Table 1 are the hypotheses 1 in the introduction.

3. Conclusion

The conclusions of this paper are as follows:

- Non projection measurements cannot affect the formation of diffraction fringes. The collapse of the wave function (or wave packet) either does not exist or does not occur on the screen.
- Through experimental and theoretical analysis, it is proved that: The weird feature of microscopic particles can be recovered after the wave function (or wave packet) collapses or the non-real quantum superposition states and QEMS do not exist (the collapse process does not exist or the measurement cannot cause the collapse of the wave function and wave packet).
- Only when the QEMS exists before the experiment and the measurement can destroy the QEMS, the experimental phenomenon about QEM is interpreted as the existence of QEM. Therefore, QEM is hypothetical.
- To verify the existence of QEM requires Bell's inequality. However, when we acknowledge that Bell's inequality does not hold, we must first acknowledge the existence of QEM. When interpreting experiments to verify Bell's inequality, it cannot be ruled out that measured polarization correlation is the original objective existence and distribution (that is to say, we cannot be sure of the existence of non-local association or QEM). Therefore, the experiment to verify the Bay's inequality is meaningless.

4. Discussion

Whether the QEM phenomenon exists and whether it has been verified has been controversial. The proposal and verification of Bell's inequality conceals the fact that the explanation of QEM is a circular argument and confuses audiovisual information. This makes more people's understanding vaguer and the debate cannot end in time.

Liangshan Liu said that the concept to be incompatibility with Einstein's locality principle is the interpretation of the wave function (or wave packet) collapse. However, the prediction of quantum mechanics is obtained by Born's probability interpretation of wave function, which is independent of the collapse interpretation of the wave function (not to mention the experimental interpretation of Bell's inequality has a logical loop). Therefore, even if the experiment of testing Bell's inequality confirms that the prediction of quantum mechanics is correct, it also cannot prove that Einstein's principle of locality is wrong⁵. This compromise can neither deny nor affirm the viewpoint of this study. Generally speaking, the understanding of compromise is not as good as that of definite conclusion. The various explanations in the interpretation system of quantum mechanics are not isolated. QEM is related to the principle of state superposition, and the principle of state superposition is related to the interpretation of double-slit diffraction experiments. If we deny the QEM phenomenon, how can the double slit diffraction

experiment phenomenon are explained? This requires further research. In⁶ made some attempts.

5. References

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