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Research Article

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Electron Diffraction Experiment Disturbed by Magnetic Field

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Abstract
The Copenhagen interpretation of quantum mechanics believes that as long as it is monitored, the diffraction fringes of electrons will disappear. There have been no scientific reports on the "electron diffraction experiment monitored by a magnetic field" for a long time (there are only popular science reports in this area). Now, the electron diffraction experiment disturbed by the permanent magnet has been completed. As a result, the interference of the magnetic field can deform and drift the electron diffraction fringes, but will not cause the diffraction fringes to disappear. It clearly shows that the interference of the measurement cannot make the wave-particle duality particles collapse into complete particles. This is an experimental counterexample in quantum mechanics (also a dark cloud over quantum mechanics). Both "the existence of the superposition of quantum states" and "the superposition of quantum states cannot withstand any observation and surveillance" are doubtful.

Keywords: Tu's Electron Diffraction Experiment, Spark Chamber, Magnetic Field Interference, Quantum Mechanical Interpretation, Quantum State Superposition, Superposition State Collapse.

Introduction
The principle of superposition of states in the existing quantum mechanics theory, the principle of wave-particle duality and the principle of uncertainty jointly determine that "as long as you observe, the superposition state will collapse, the wave-particle duality will be destroyed, and the uncertainty relationship will also be destroyed", the diffraction fringes of microscopic particles will disappear.

We are eager to find out whether we can obtain the path information and diffraction fringes at the same time for the double slit diffraction experiment. Delayed choice quantum eraser does not directly affect the photons involved in the diffraction, but are validated by affecting the photons that have quantum entanglement with the photons involved in the diffraction [1–14]. This type of experiment is an extension of the orthodox quantum mechanics view of "as long as you monitor, the diffraction fringes of particles will disappear." Even delayed monitoring of shadow particles can destroy the diffraction characteristics of particles. Their disadvantage is that the monitoring is not to directly monitor the particles participating in the diffraction but to influence the body by monitoring the shadow of the particles.

To achieve unambiguous verification of whether the path information and diffraction fringes can be obtained at the same time, it is necessary to directly disturb (monitor) the particles participating in the diffraction. R. G. Chambers has done an experiment in which the electron beam disturbed by magnetic field [15]. However, this experiment is not an experiment in which the particles involved in the diffraction are interfered, nor an electron diffraction experiment, but an electron microscope model experiment. Therefore, it is independent of slit diffraction. The author of this paper has done the electron diffraction experiment disturbed by the magnetic field directly, and obtained the electron diffraction pattern of deformation and drift (Hereinafter, this experiment is called Tu's experiment). In this way, by using a magnetic field to monitor electrons, it is hoped that the electron path information and diffraction pattern can be obtained simultaneously. The experiments described in References show that "the quantum superposition state of particles to be destroyed" and "the wave of particles disappears" are almost synchronized [1-14]. Considering this synchronization, Tu's experiment can show that magnetic field monitoring cannot cause the collapse of the superposition system of quantum state. Considering that the superposition of quantum states is hypothetical from start to finish, Tu's experiment can also show that superposition of quantum states may not happen at all. In short, Tu's experiment found a dark cloud over quantum mechanics, challenging the existing orthodox interpretation of quantum mechanics.

Electron Diffraction Experiment in Which the Electron Beam Is Disturbed by A Magnetic Field (Tu's Experiment)

The experiment was first completed by the author in 2018. It was not until December 2020 that I realized the importance of the experiment and repeated the experiment (and took a video), and wrote this article. The way to realize the significance of this experiment is to first assume that the experimental result is unknown, and estimate the experimental result according to the orthodox quantum mechanics interpretation. When the actual experimental results are inconsistent with the estimated experimental results, and you know that no one has done this experiment before, you will suddenly realize the great significance of the experiment. The magnetic field interference in this experiment can be local interference or full-range interference. For the convenience of description, the experiment is called Tu's experiment hereinafter.

Experiment Category: Qualitative Experiment.

Experimental Instrument: Electron Diffractometer; Permanent Magnet.

Experimental Method: Start the electron diffractometer. After the instrument is running smoothly and a series of concentric circular diffraction stripes appear, the permanent magnet is moved close to the electron diffractometer and moved between the slit and the phosphor screen, so that the electron rays are interfered by the magnetic field within this distance. Observe the changes of the electron diffraction pattern.

Experimental Phenomenon: The diffraction pattern can drift and deform, but it does not disappear. The position of the permanent magnet is different, the degree of deformation and the degree of drift of the diffraction pattern are different (See Figure 1).

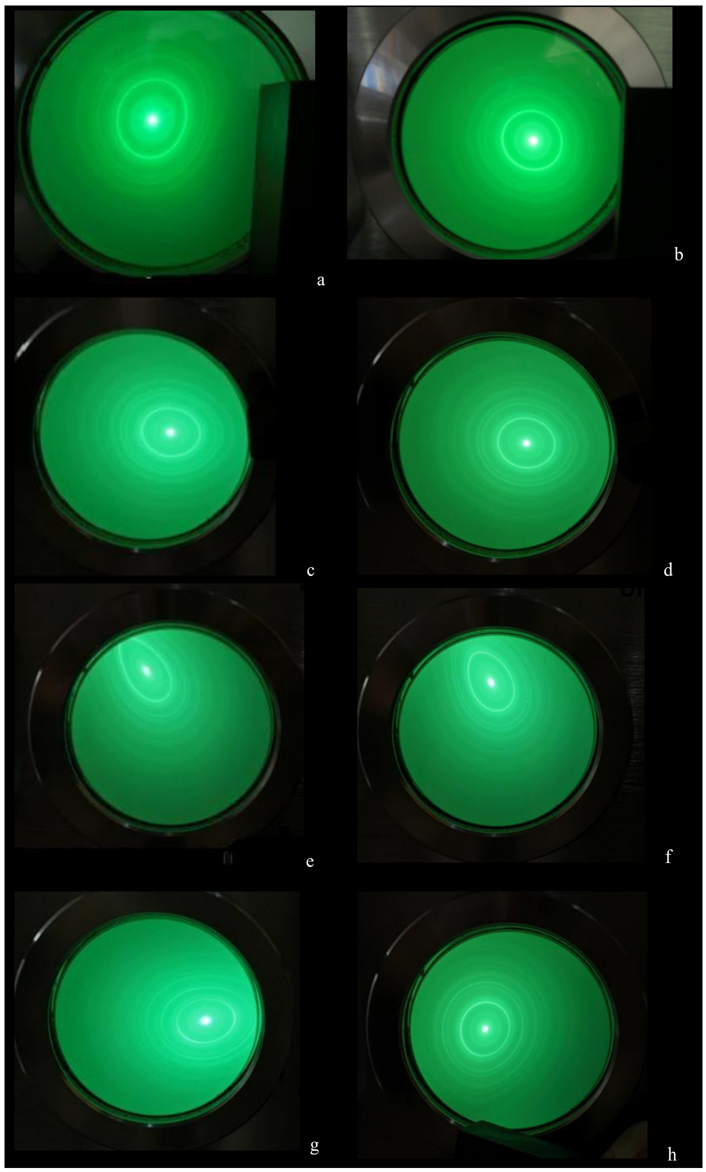

Figure 1. Experimental results of the qualitative effect of magnetic field on electron diffraction pattern. The position of the magnet is different, the degree of deformation and drift of the diffraction fringe is different.

Reliability of Experimental Results: The experiment process is simple and clear, the result is unambiguous with the problem it explains, and the conclusion is very reliable (A large number of facts show that the simpler the experiment, the less controversial the conclusion).

Repeatability of the Experiment: Repeatable at any time (good repeatability). Readers can repeat Tu's experiment immediately. The method is to take one or two permanent magnets and shake them back and forth on the screen of the diffractometer to observe the changes in the diffraction pattern.

Conclusion: magnetic field monitoring cannot destroy the diffraction characteristics of electrons.

One of the Experimental Inferences: Since the magnetic field interference cannot make the electron volatility disappear, the use of magnetic field monitoring can completely prevent the double-slit diffraction fringes from disappearing.

Experimental Inference 2: The interference of the magnetic field can prevent electrons from breaking away from the micro world and entering the macro world.

Experimental Inference 3: the interference of the magnetic field cannot make the electrons with wave-particle duality show complete particle properties, and also cannot make the electrons in the quantum superposition state collapse into a state with a clear electron spin.

The reason is that, in quantum mechanics, the wave function is used to describe the motion state (behavior) of a particle. The solution of the free electron wave function is in a superposition state. The wave state and particle state of microscopic particles are two solutions of linear wave functions. In this way, the fluctuation state and the particle state of the microscopic particles can be superimposed. The solution of the free electron wave function is in a superposition state. External interference will cause the superposition state of wave and particle and the superposition state of spin-up and spin-down to collapse at the same time. The fact is that the scientists of quantum mechanics admit that free particles are neither complete waves nor complete particles. Since an interference cannot make its wave-particle superposition collapse, it cannot make its spin superposition collapse.

Experimental Inference 4: The characteristics of electron diffraction are not afraid of the monitoring of magnetic field and electric field. It is possible for us to obtain the electron diffraction pattern and the electron movement path information at the same time. This inference can be verified by the electron diffraction experiment in the spark chamber. This corollary and corollary three show that both the conclusion that Schrödinger 's cat cannot stand the observation and the results of the delayed choice quantum eraser experiment are questionable.

Experimental Inference 5: Everyone has known for a long time that the superposition of different quantum states of a single particle and the collapse of this superposition state are both hypothetical. Once such a state superposition occurs, it will be separated from reality and must go through the collapse and return to reality. In the case of interference, the collapse of the quantum superposition state of a single particle does not occur. It is very likely that the superposition of quantum states of a single particle has not occurred at all.

According to existing theoretical judgment, as long as there is a strong magnetic field outside the slit, even if the beam that has passed through the slit has resumed wave-particle duality by returning to the free particle state again, the diffraction fringes will not appear again because there is no slit behind it. We can also give the electron beam a fixed electric field interference (monitoring) for electron diffraction experiments. In this way, not only can the Tu's experiment be further verified, but it is also convenient to control the intensity of interference and do some quantitative research.

Discussion on The Significance of The Results of The Electron Diffraction Experiment Disturbed by The Magnetic Field

If the fact is as explained in Copenhagen, the electron wave function collapses in the magnetic field and only exhibits particle properties, the electron diffraction experiment that is disturbed by the magnetic field after electrons passing through the slit will not show diffraction fringes. The Tu's experiment has shown that diffraction fringes can still appear in the electron diffraction experiment disturbed by the magnetic field (that is, the volatility of the electrons does not disappear due to the interference of the magnetic field). This denies the existing interpretation of quantum mechanics (especially the Copenhagen interpretation). In other words, the existing quantum mechanics interpretation system has been strongly challenged.

People say that Schrödinger's cat will collapse just by looking at it. However, I found through experiment (according to Tu's experiment) that even with a whip, the Schrödinger cat does not collapse. The experimental method is to use the magnetic field to interfere with the electron beam in the diffraction experiment and observe the changes of the diffraction fringes. This is an exception to verify the interpretation system of quantum mechanics. The exception is a dark cloud above quantum mechanics. This dark cloud is also the fuse and guide for the quantum mechanics revolution. Tu's experiment is an exception in quantum mechanics experiments. To find an experimental exception is to find the fuse of the scientific revolution.

It is strongly recommended that readers repeat the Tu's experiment and create conditions to do the double-slit electron diffraction experiment under the interference of the magnetic field and the double-slit electron diffraction experiment in the spark chamber. The existing quantum mechanics interpretation system believes that in the spark chamber, the high-speed electrons are in the collapsed state of quantum superposition, and can only show complete particle properties without electron diffraction. For the electron diffraction experiment in the spark chamber, there are only inferences and no actual observations. Therefore, it is necessary to do it. There are only three reasons for denying the significance of electron diffraction experiments in spark chambers: First, the theory predicts that electron diffraction patterns cannot be obtained in the spark chamber; Second, there are many experiments that indirectly show that electron diffraction patterns cannot be obtained in the spark chamber: Third, Tu's experiment is too simple. There are several reasons why it is definitely meaningful to do electron diffraction experiments in the spark chamber: First, Tu's experiment has proved that the magnetic field cannot make the electron diffraction pattern disappear (A thousand indirect indirect proofs are not worth the last direct experimental proof); Second, the existing interpretation system of quantum mechanics has been questioned by many people [16-20]. Third, for qualitative experiments, the simpler the experiment, the more reliable the qualitative conclusion will be; Fourth, in theory, it is entirely possible to establish local-realism quantum mechanics [21-23]. The literature shows that the theory of quantum state superposition and wave function collapse theory means that do not support electrons does not support the existing quantum mechanics interpretation system. But one cannot deny the mathematical formal system of quantum mechanics [21-23].

Concluding Remarks

In this world, the Tu's experiment was completed by humans for the first time. Tu's experiment is a counterexample in quantum mechanics experiment. According to Tu's experiment, some predictions can be made: the electron diffraction pattern can also be obtained by doing the electron diffraction experiment in an electric field; humans have the hope of obtaining path information and diffraction fringes at the same time. Tu's experiment was successful, but it was too single. The author hopes that it will be confirmed by more people in the "electron diffraction experiment in the spark chamber" and the "double-slit electron diffraction experiment monitored by a magnetic field". The author also hopes that people will trace the root cause of the error in the Copenhagen interpretation.

Statement

This article was not published on a website other than the preprint, and it was not submitted to other publishers at the same time. I declare that the authors have no competing interests as defined by your journal, or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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