Experimental Study of Bohm’s Trajectory Theory --- Comprehensive Double Slit Experiments (2)

Hui Peng

*Corresponding author: davidpeng1749@yahoo.com

Received March 05, 2021; Revised April 11, 2021; Accepted April 23, 2021

Abstract Young’s double slit experiments, which represent the mystery of quantum mechanics, have been interpreted by quantum probability waves and by de Broglie-Bohm trajectories/pilot waves. Computer simulations of Bohm’s theory predict that (1) trajectories cannot cross, and (2) there is a triangle-shape area behind the double slit, in which there is no trajectory, i.e., no photons. In this article, we report the observations of novel comprehensive double slit experiments, which show that trajectories exist and cross in the triangular area. We show new phenomena that, in 2D cross double slit experiments and which way 2D cross double slit experiments, photons propagate along trajectories in the far field, and behave as particle and distribute as wave.

Keywords: double slit experiments, comprehensive double slit experiment, cross double slit experiments, which way double slit experiments, which way cross double slit experiments, de Broglie-Bohm theory, trajectory theory

Cite This Article: Hui Peng. “Experimental Study of Bohm’s Trajectory Theory --- Comprehensive Double Slit Experiments (2).” *International Journal of Physics*, vol. 9, no. 3 (2021): 139-150. doi: 10.12691/ijp-9-3-1.

1. Introduction

The evolution of the interpretations of the wave and particle natures of light/photons has a long history. In 1801, Young performed a double slit experiment, which demonstrated that light could behave as waves. The standard interpretation of Young’s double slit experiment is that the light behaves the same as waves before and after passing through the diaphragm of the double slit. Namely, before landing on a detector, photons behave as waves. On the other hand, photons are always found to be absorbed at the discrete points of the detection screen, as individual particles; the interference pattern appears via the varying density of these particles hit on the screen.

de Broglie-Bohm’s theory provides an alternative interpretation [1,2,3], which states that photons propagate along trajectories. While each trajectory passes through only one slit, the wave passes through both; the wave generates an interference pattern that guides the trajectories of photons as particles.

One prediction of computer simulations of de Broglie-Bohm theory is that the possible trajectories cannot cross [4,5,6]. We notice an implicit prediction that there is a triangle-shaped area behind the double slit, in which there is no trajectory, namely, no particle/photons pass through this area (hereafter referred to as “predictions”). To our knowledge, no experiment has either been performed or proposed to test these two predictions. The interpretations of the double slit experiments have been the subject of many discussions over the years, for example, references [7,8,9] and references within.

Recently, to explore the mystery of the double slit experiments, the virtual box model was introduced [10]. The double slit apparatus is divided into 3 zones: zone-1 (Z-1) is from the source to the diaphragm of the double slit that is the left boundary of the virtual box, the virtual box including the diaphragm of the double slit is zone-2 (Z-2), and zone-3 (Z-3) is from the right boundary of the virtual box to the detector. The right-side boundary of Z-2 needs to be determined. The photons’ behavior in zone-1 and zone-3 is studied by comprehensive double slit experiments [10] that show that photons behave as particles before striking at the diaphragm of the double slit and before striking at the detector/screen; that each fringe is formed independently and can be formed partially; and that, in Z-3, photons propagate along trajectories as predicted by pilot wave theory. The experimental results are consistent. One of the characteristics of those experiments is that the experimental results are visually observable.

In this article, we propose and perform more comprehensive double slit experiments that test above mentioned two predictions of computer simulations of de Broglie-Bohm trajectory theory in Z-2 and Z-3. We show that, in which way 2D cross double slit experiments, photons propagate along trajectories in Z-3.

2. Outline of Experiments

That the trajectories cannot cross is a well-known prediction for particles (Figure 1a, extracted from reference [4]) and for photons (Figure 1b, extracted from reference [11]). In addition, computer simulations predict the existence of virtual triangular areas (Figure 1c) and no trajectory in the areas.
Let’s take a look at those simulations. We observed an implicit result that the height of the triangle is longer than the magnitude of the spacing between two slits (Figure 1c). For example, if the spacing between two slits is 1 mm, then the distance from the vertex of the triangle to the double slit would be longer. Based on the implicit result, it is possible to design experiments to observe, by the naked eye, whether there are photons in the triangular area.

3. Comprehensive Double Slit Experiments

3.1. Young’s Double Slit Experiments with Shield: Trajectories Cross

First, let us test whether there are photons in the triangular area.

**Experimental Setup:** making an “L”-shaped shield (grey colored) and gluing it to an object (Figure 3). The shield is 25 mm long, 8 mm wide, and 0.12 mm thick.
Place the shield along the virtual centerline and let one end of the shield contact the double slit at the point between two slits, where the spacing “d” between two slits is 1 mm (Figure 4a). In the previous comprehensive double slit experiments [10], we placed a shield at a position 25 mm from the double slit. Figure 4b is the picture taken from the right side of the shield, and Figure 4c is the picture taken from the left side.

**Observation** (Figure 5): Photographs show that the light from the right-side slit shines on the right side of the shield (Figure 5a). Simultaneously, the light from the left side slit shines on the left side of the shield (Figure 5b). The light spots on both sides of the shields indicate that there are light/photons in the triangle area; and that the light intensity is higher near the slits.

The interference pattern exists (Figure 5d), but is dimmer. Note that this observation is consistent with the previous observation [10].

For comparison, Figure 5c shows the interference pattern of the same double slit, but without the shield.

**Experiment-2:**
In the experiment-2, we show that, with a narrow shield, the light still shines on the shield.

**Experimental Setup:** making a shield (gray colored) and gluing it to an object (Figure 6). The shield is 2.8 mm long, 9.5 mm wide, and 0.12 mm thick.

**Experimental Procedure:** The procedure is the same as that of Experiment-1. Placing the shield to contact the double slit at the position between two slits (Figure 7a and Figure 7b). Then turning on the laser.

**Observation:** Photographs show that the light from the right-side slit shines on the right side of the shield (Figure 8a). Simultaneously, the light from the left-side slit shines on the left side of the shield (Figure 8b). The light spots on both sides of the shield indicate that there are light/photons in the triangle area.

The Figure 9a shows the interference pattern of the double slit without a shield. Figure 9b is the interference pattern of the same double slit with the shield.

The observations of Experiment-1 and Experiment-2 indicate that, indeed, there are light/photons in the triangular area (Figure 5 and Figure 8). Namely, the trajectories/rays of photons/light not only do exist but also cross in the triangular area (Figure 10). Thus, we suggest...
that the experimental observations challenge either the predictions of computer simulation of the trajectory theory or the trajectory theory itself.

![Figure 8. Experiments with Shield Contacting Double Slit](image)

![Figure 9. Regular interference pattern vs. interference pattern of double slit with shield](image)

![Figure 10. Schematics of Experiment-1](image)

![Figure 11. Schematics of Experiment](image)

Note that Figure 10 is not to scale because there is no experimental evidence showing where is the vertex of the virtual triangle.

It is reasonable to assume that, when we remove the shield, the behavior of light/photons in and near the triangular area would be the same as that before removing the shield, as shown in Figure 11. Namely the trajectories from both slits would cross the virtual centerline when there is no shield. On the contrary, according to the interpretations of trajectory theories, and even for some interpretations of wave-based theories, there would be no light/photons, and trajectories cannot cross in the triangular area.

It is heuristic to compare with the existing experimental observations [10]. The previous experimental results show that the shields, even 1800 mm long, either contact the detector or at the positions near the detector, have no noticeable effect on the interference pattern.

Note that the experiments of this Section maybe used to determine the boundary of Z-2.

### 3.2. Young’s Double Slit Experiments with Blocker: Trajectories Cross

**Experiment-3:**

**Experimental Setup (Figure 12):** utilizing the regular double slit apparatus. The blocker is placed between the double slit and the detector. In previous comprehensive double slit experiments [10], we placed the blocker(s) to block individual fringes. In the experiments of this article, we place the blocker to block more, even half, of the fringes simultaneously. The top edge of the blocker is close to the centerline between two slits. The blocker is moved to different positions to block different fringes to test the interpretations. For example, according to Bohm’s theory, photons’ trajectories from different slits cannot cross, namely, blocking one side of fringes should not affect the fringes formed by photons passing through other slit.

![Figure 12. Schematic drawing of Young’s double slit apparatus with blocker](image)

Where “X” represents the distance between the double slit and the blocker. The distance between the double slit to the detector is 200 inches.

The purpose is to test, when we place the blocker to block the portion of the interference pattern, what will happen to the remaining portion of the interference pattern. The position of “X” starts from the position closer to the double slit and moves away towards the detector.

Note that in experiments-3, the fringes on the left side of the zeroth order fringe carry negative m numbers; the right-side fringes carry positive m numbers. The spacing between two slits is 0.25 mm.

**Experimental procedure:** Turning on the laser source, the interference pattern is shown on the detector (Figure 13).

![Figure 13. Interference pattern of Young’s double slit experiment](image)
Then, placing the blocker at a position such that (1) it is near the double slit, but the interference pattern still exists, and (2) all the negative “m” fringes are blocked.

**Experimental Setup-1:** The blocker is placed at one inch from the double slit and block the negative “m” fringes. **Observations (Figure 14):** We observe the following: (1) The positions of the zero and positive m fringes are not affected, which is consistent with trajectory theory; (2) On the other hand, each remaining fringe becomes dimmer.

We suggest that the reason of the naked eye observable "dimmer" is that the blocker is near the double slit, where the density of light/trajectories is high and thus more trajectories cross and are blocked per unit area.

![Figure 14. Block negative m fringes](image_url)

According to the Bohm theory, the blocked photons from the left slit would make no contribution to the right-side fringes, while the unblocked right slit would make no contribution to the left-side fringes. The experimental observations show the opposite; and thus, the trajectory theory is challenged.

Note that there is a “tail” on the left side of the zero-fringe (Figure 14), which is due to the diffraction of the edge of the blocker [12].

### 3.3. Cross-Double Slit Experiments with Blocker(s)

The purpose of the experiments below is to test the behaviors of light/photons in Z-3 near the detector. In the following experiments, the blocker is 72 inches away from the detector/screen. To avoid losing generality, we perform experiments with cross-double slits [13].

The “blocker-AB” blocks the patterns created by double slit-AB, while the “blocker-CD” blocks the patterns created by double slit-CD.

First, let us show the interference pattern of a cross- double slit experiment (Figure 15) without a blocker.

**Experiment-4:** Place blocker-AB to block the different portions of the interference pattern created by double slit AB. We will place blocker-AB at different positions.

Note that in the experiments below, we assign the positive and negative m/n numbers as the followings:

1. For the horizontal interference patterns, the fringes on the left side of the zeroth order fringe carry negative m numbers; the right-side fringes carry positive m numbers.
2. For the vertical interference patterns, the fringes below the horizontal fringe carry positive n numbers; the fringes above carry negative n numbers.

**Experimental setup-1 (Figure 16a):** Placing blocker-AB such that it blocks the half of the interference pattern, except the zeroth order fringe.

**Observation (Figure 16b):** The negative m fringes are blocked. The positions of the right-half fringes of the interference pattern are not affected by the blocker. The positions of the fringes in the vertical interference pattern are not affected. This is consistent with the statement that the photons move along trajectories.

![Figure 15. Cross double slit experiment](image_url)

![Figure 16. Block left half of the interference pattern of double slit-AB](image_url)
Note that when state “not affected” here and below, we mean that at the naked eye level, there is no noticeable effect. We suggest that the reason of no naked eye observable “dimmer” is that the blocker is near the detector, where the density of light/trajectories is low and thus, less trajectories cross and are blocked per unit area.

**Experimental setup-2:** Placing blocker-AB at different positions, such that it blocks the different portions of the interference pattern created by double slit-AB.

![Figure 17](image1.png)

**Figure 17.** Block fringes

**Observation:** Figure 17a shows that the part of fringes is blocked. Figure 17b shows that, for blocker-AB at different positions, the different part of fringes is blocked. In both setups, the positions of the remaining fringes are not affected by blocking, which shows that each fringe is created independently and that photons move along trajectories.

**Experimental setup-3** (Figure 18a): Placing blocker-CD, such that it blocks the bottom half of the interference pattern created by double slit-CD.

**Observation:** Figure 18b shows that the bottom-half fringes are blocked. The remaining fringes are not affected by blocking, which shows that each fringe is created independently and that photons move along trajectories.

![Figure 18](image2.png)

**Figure 18.** Block bottom half of the interference pattern of double slit-CD

**Experimental setup-4:** Placing the blocker-CD at different positions, such that it blocks the different portions of the interference pattern created by double slit-CD.

**Observation:** Figure 19a shows that the part of fringes is blocked. Figure 19b shows that the different part of fringes is blocked. In both setups, the remaining fringes are not affected by the existence of the blocker, which shows that each fringe is created independently and that photons move along trajectories.

**Experimental setup-5:** Placing both blocker-AB and blocker-CD simultaneously to block the different portions of the 1D interference patterns created by double slit-AB and double slit-CD, respectively.

**Experimental setup-1** (Figure 20a): Placing both blocker-AB and blocker-CD simultaneously.

**Observation:** Figure 20b shows that (A) the bottom half fringes created by double slit-CD are blocked; and (B) the left-half fringes created by double slit-AB are blocked. The remaining fringes are not affected by the existence of the blockers, which shows that each fringe is created independently and that photons move along trajectories.

**Experimental setup-2:** Placing both blocker-CD and blocker-CD simultaneously.

**Observation:** Figure 21a shows that the part of the horizontal fringes is blocked, while the part of the vertical fringes is blocked. The remaining fringes are not affected by blocking. Figure 21b shows that the part of the horizontal fringes is blocked, while the part of the vertical fringes is blocked. The remaining fringes are not affected by blocking. The observations show that each fringe is created independently and that photons move along trajectories.

![Figure 19](image3.png)

**Figure 19.** Block different fringes created by double slit-CD
Figure 20. Blocking half of interference patterns created by both double slit-AB and double slit-CD

Figure 21. Patterns with blocker-AB and blocker-CD

**Experiment-6:** Tilt-cross-double slit experiments.

The tilt-cross-double slit apparatus is employed, which consists of a vertical double slit-AB and a tilt-double slit-CD crossing to it. First let us show the pattern without blocker (Figure 22).

Then blocker-AB was placed to block the different portions of the interference pattern created by double slit AB. We will place blocker-AB at different positions.

In the experiments below, we assign the positive and negative, m and n, numbers as the followings:

1. For the horizontal interference patterns, the fringes on the left side of the zeroth order fringe carry negative m numbers; the right-side fringes carry positive m numbers.
2. For the tilt interference patterns, the fringes below the zeroth order fringe carry positive n numbers; the fringes above the zeroth order fringe carry negative n numbers.

**Experimental setup-1** (Figure 23a): Placing blocker-AB such that it blocks half of the interference pattern created by double slit-AB.

**Observation:** Figure 23b shows that the horizontal positive m fringes are blocked. The remaining fringes are not affected by blocking. The observations show that each fringe is created independently, that photons move along trajectories.

Figure 22. Tilt cross double slit experiment

Figure 23. Tilt cross double slit experiment with blocker-AB
Experimental setup-2 (Figure 24a): Placing blocker-CD such that it blocks half of the interference pattern created by double slit-CD.

Observation: Figure 24b shows that the tilt positive n fringes are blocked. The remaining fringes are not affected by blocking.

Experimental setup-3 (Figure 25a): Placing blocker-AB and blocker-CD such that half of the interference pattern created by double slit-AB is blocker, simultaneously, half of the interference pattern created by double slit-CD is blocked.

Observation: Figure 25b shows that the horizontal negative m fringes are blocked, while the tilt positive n fringes are blocked. The remaining fringes are not affected by blocking. Figure 25c shows that the horizontal positive m fringes are blocked, while the tilt positive n fringes are blocked. The remaining fringes are not affected by blocking. The observations show that each fringe is created independently and that photons move along trajectories.

Note that all experiments in Section 3.3 are observed by the naked-eye, and there are no noticeable changes in the brightness of fringes. We cannot determine whether the trajectories are crossing at the positions near detector by the experiments in Section 3.3.

What we have shown are that the 2D interference patterns are created independently and partially; and that, in Zone-3, photons move along trajectories and behave as particles.

3.4. Which Way Cross Double Slit Experiments with Blocker(s)

The which way double slit experiments show that the motion of the particles/photons depends on whether both slits are open, and would be different if one slit was closed. With only one slit open, the distribution of the photons on the screen would create a different pattern that shows the particle nature, according to the practical definition of wave/particle. Bohm’s theory has the same statement [14].

The observation of the regular which way double slit experiment is shown in Figure 26, where an “observer” is set behind slit A (denoted by dashed slit A). For the Young’s double slit experiment, if the trajectory theory holds, e.g., trajectories do not cross, one knows which slit a photon passing through without observing photons and destroying the interference pattern [14].

The regular which way 1D-double slit experiments support Bohr’s complementarity principle, i.e., behave either as waves (Figure 13) or as particles (Figure 26), but cannot be both in the same experiment.

Let’s block half of the pattern. Then we observe the following (Figure 27).

The which way 1D-double slit experiments
A which way 2D cross double slit experiment was performed (Figure 28) [15].

![Figure 28](image)

**Figure 28.** Which way 2D cross double slit experiment

By the same argument that the which way 1D double slit experiments support the complementarity principle, the which way 2D cross double slit experiments oppose the Bohr’s complementarity principle. Namely, in the same experiment with the same light source, the same diaphragm of the cross double slit and the same detector, light/photons behave as both waves and particles.

The question is how a photon “knows” which slit it passes through and behaves accordingly.

Now let us block portions of the patterns of the cross double slit apparatuses.

**Experiment-7:** Which way cross double slit experiments with blocker(s)

**Experimental Setup-1** (Figure 29a): Place blocker-AB at different positions between the cross double slit and the screen.

![Figure 29](image)

**Figure 29.** Which way 2D cross double slit experiments with blocker-AB

**Observations:** Figure 29 (b) shows that block-AB blocks the right half of the pattern. Figure 29c shows that the left half of the pattern created by double slit-AB is blocked. In both setups, the remaining parts of both the pattern created by the blocked double slit-AB and the interference pattern created by the double slit-CD are not affected, which is the consequences of photons propagating along trajectories.

**Experimental Setup-2** (Figure 30a): Place blocker-CD between the cross double slit and the screen.

**Observations:** Figure 30b shows that block-CD blocks the bottom half of the interference pattern created by the double slit-CD, but it does not affect the top half of the interference pattern. The pattern created by the double slit-AB is not affected.

**Experimental Setup-3** (Figure 31a): Placing both blocker-AB and blocker-CD between the cross double slit and the screen.

**Observations:** Figure 31b shows that block-CD blocks the bottom half of the interference pattern created by the double slit-CD, but does not affect both the top half of the interference pattern and the right half of the pattern created by the double slit-AB. Block-AB blocks the left-half pattern created by the double slit-AB, but does not affect both the right half of the pattern and the top half of the interference pattern created by the double slit-CD. The phenomena are the consequences of photons propagating along trajectories.

Which way 2D tilt cross double slit experiments have been performed (Figure 32) [15].

Next let us perform the which way tilt cross double slit experiments with blocker(s).

**Experiment-8:** Which way 2D tilt cross double slit experiments with blocker(s)

**Experimental Setup-1** (Figure 33a): Placing blocker-AB between the tilt cross double slit and the screen.

**Observations:** Figure 33b shows that block-AB blocks the right half of the pattern created by the double slit-AB with “observation at slit A”, while it does not affect both the left half of the pattern and the interference pattern created by the double slit-CD.

**Experimental Setup-2** (Figure 34a): Placing blocker-CD between the tilt cross double slit and the screen.

**Observations:** Figure 34b shows that block-CD blocks the bottom half of the interference pattern created by the tilt double slit-CD, while it does not affect both the top half of the interference pattern and the pattern created by the double slit-AB.

**Experimental Setup-3** (Figure 35a): Placing both blocker-AB and blocker-CD between the tilt cross double slit and the screen.

**Observations:** Figure 35b shows that block-CD blocks the bottom half of the interference pattern created by the tilt double slit-CD, but it does not affect both the top half of the interference pattern and the right half of the pattern created by the double slit-AB. Block-AB blocks the left half of the pattern created by the double slit-AB with “observation at slit A”, but it does not affect both the right half of the pattern and the top half of the interference pattern created by the double slit-CD.

**Figure 35c** shows that block-CD blocks the top half of the interference pattern created by the tilt double slit-CD, but it does not affect both the bottom half of the interference pattern and the left half of the pattern created by the double slit-AB. Block-AB blocks the right half of the pattern created by the double slit-AB, but it does not affect both the left half of the pattern and the bottom half of the interference pattern created by the tilt double slit-CD.
Figure 30. Which way 2D cross double slit experiments with blocker-CD

Figure 31. Which way 2D cross double slit experiments with blocker-AB and blocker-CD

Figure 32. Which way tilt cross double slit experiments

Figure 33. Which way tilt cross double slit experiment with blocker-AB

Figure 34. Which way tilt cross double slit experiment with blocker-CD
Although each photon travels along its own trajectory, it is a challenge for the trajectory theory to interpret the which way 2D cross double slit experiments described in Section 3.4.

![Diagram](image)

**Figure 35.** Which way tilt cross double slit experiment with blocker-AB and blocker-CD

4. **Novel Diaphragm for Double Slit Experiments**

In preliminary Experiment-1 and Experiment-2 of Section 3.1, the shields contact the diaphragm of the double slit (Figure 4, Figure 5, Figure 7 and Figure 8). We want to emphasize that, in those Figures, the “contact” is a macroscopic-type contact, i.e., actually, there are “gaps” between the shield and the diaphragm of the double slit.

For further comprehensive double slit experiments, we design new apparatuses to eliminate the gap between the shield and the double slit, they are one piece now (Figure 36).

![Diagram](image)

**Figure 36.** Novel Diaphragm for Double Slit Experiments

5. **Summary**

We propose and perform new comprehensive double slit/cross-double slit experiments with simple apparatuses to test the computer simulation of the trajectory theories and study the basic quantum mystery. Novel phenomena are discovered.

The above preliminary experiments (as shown in Figure 37) show that: (1) there are trajectories/photons in the triangular area; (2) the trajectories/photons from each slit cross in the triangular area and beyond; (3) when some fringes are blocked near the triangular area, the brightness of remaining fringes becomes dimmer; (4) at the far field in Z-3, the trajectories are straight lines; and (5) when some fringes are blocked at the far field in Z-3, the brightness of remaining fringes has no noticeable change.

![Diagram](image)

**Figure 37.** Double slit experiments with shield contacting double slit

We suggest that the reason of the naked eye observable “dimmer of the pattern” is that when the blocker is near the double slit, where the density of light/trajectories is high, thus more trajectories cross and are blocked per unit area. And the reason of no naked eye observable “dimmer of pattern” is that the blocker is near the detector, where the density of light/trajectories is low and thus, less trajectories cross and are blocked per unit area.

We suggest that without the shield, trajectories of photons exist and cross inside and outside of the triangular area (Figure 38).

![Diagram](image)

**Figure 38.** Double slit Experiments without shield

In the triangular area, the predictions of the computer simulations of de-Broglie-Bohm theory are challenged and, in the far field of Z-3, de Broglie-Bohm theory holds approximately.

Now, we have more complex and comprehensive experimental data, which suggest a criterion for interpretations of the double slit phenomena.

**Remark on which way double slit experiments:** To explore the nature of photon further, 1D-double-slit experiment was extended to which-way-1D-double-slit experiment. Technically feasible realizations of which-way experiments were proposed in the 1970s [16,17].
A photon is observed near a slit by utilizing a photoelectric-detector to register the photon, practically it blocks the path of photons, namely “observing” a photon passing through a slit is equivalent to cover the slit [18] [19].

We argue that, if we change the focus from detecting photons to how to perform the experiment, to cover a slit of a double slit apparatus is equivalent to use a single slit apparatus, namely,

\[ \text{Observing photons = blocking photons = covering a slit = using a single slit} \]

When the photon is detected, the interference pattern disappears.

The operational definition of “wave/particle” stands for “ability/inability to create interference”. [20,21,22].

Acknowledgements

The author would acknowledge Dr. Mirjana Bozic and Dr. Ian Miller for discussions.

References

[1] de Broglie, in "Ondes et mouvements" [Waves and Motions], Gauthier-Villars, Paris, 1926.
[2] de Broglie, L. 1987. “Interpretation of quantum mechanics by the double solution theory”. Ann. Fondation Louis de Broglie 12: no 4.
[3] Bohm, D. 1952. “A Suggested Interpretation of the Quantum Theory in Terms of "Hidden" Variables”. J Phys Rev. 85: 166-193.
[4] C. Philippidis, C. Dewdney and B.J. Hiley, “Quantum Interference and the Quantum Potential”, Il Nuovo Cimento, vol.52B, No.1 (1979).
[5] P.R. Holland, The Quantum Theory of Motion, An account of the de Broglie-Bohm causal interpretation of quantum mechanics, Cambridge University Press (1993).
[6] S. Goldstein, “Bohmian Mechanics”, Plato.Stanford.edu, 2017.
[7] I.J. Miller, 2013. Guidance waves an alternative interpretation of quantum mechanics. (http://www.amazon.com/dp/B00GT8BLJ6).
[8] M. Davidovic, et al., “Trajectory-based interpretation of Young’s Experiment”, Phys. Scr. T153, 014015 (2013).
[9] Andrea Petrucci, “Clues to detect the Pilot Wave in a photon double-slit interference experiment”, https://www.researchgate.net/publication/318785087, 2017.
[10] H. Peng, “Experimental Study of Mystery of Double Slit”, International. J. of Phys. 9(2):114-127. 2021.
[11] Sacha Kocsis, et al., “Observing the Average Trajectories of Single Photons in a Two-Slit Interferometer”, Science 03 Jun 2011: Vol. 332, Issue 6034, pp. 1170-1173.
[12] M. D. Davidovic, et al, J. of Russian Laser Research, Vol 39, 438-447, 2018.
[13] Hui Peng. Observations of Cross-Double-Slit Experiments. International Journal of Physics. 2020; 8(2): 39-41.
[14] R. Tumulka, “Bohmian Mechanics”, arXiv: 1704.08017v2[quant-ph] April 2018.
[15] H. Peng, “Observation of Which-Way-2D-Cross-Double-Slit Experiments. International. J. Phys. 8: 133-157, 2020.
[16] Bartell, L. “Complementarity in the double-slit experiment: On simple realizable systems for observing intermediate particle-wave behavior”. Physical Review D. 21 (6): 1698-1699, 1980.
[17] Zeilinger, A. “Experiment and the foundations of quantum physics”. Reviews of Modern Physics. 71 (2): S288 S297, 1999.
[18] S. Frabboni, G. Gazzadi, and G. Pozzi, Appl. Phys. L. 97, 263101, 2010.
[19] H. J. W. Müller-Kirsten, Introduction to Quantum Mechanics. World Scientific, 2006.
[20] G. Greenstein and A.G. Zajonc, The Quantum Challenge: Modern Research on the Foundations of Quantum Mechanics, Jones and Bartlett, Boston, 1997.
[21] J. Baggott, The Quantum Story: A History in. Oxford University Press, 2011.
[22] R. Ioniciu and D.R. Terno, Phys. Rev. Lett. 107, 230406, 2011.