Pisco Med Publishing

Original Research Article

Research on the Superluminal Transmission of Information

Cheng Li

Haihui Zhongxing Center of science and Technology,100166, Beijing, China

Abstract: For a pair of entangled photons, observing one will cause another quantum state to collapse instantaneously. If improvement is made based on the double-slit erasure experiment, the collapse of the quantum state caused by the observation can be found independently and instantly at the remote end. It shows that the collapse state is defined as 1 or 0, which can be used to transmit information.

Keywords: Superluminal; Quantum entanglement; Double-slit erasure

1. Technical background

According to the classical theory, the transmission of information is inseparable from matter or energy as a messenger, so that the speed of communication is limited to the speed of light, but this is not the case. For two entangled photons, the observation of one photon causes the quantum state of the other photon to collapse, and this transfer speed is considered to be much greater than the speed of light[1]. This paper believes that the quantum entanglement effect can be used to transmit information at superluminal speed.

2. The double slit erasure experiment

First, let's review the double slit erasure experiment done by S. P. Walborn et al[2]. As shown in Figure 1, the entangled photons generated by laser irradiating BBO are distributed to the p and s ends. In front of the double slit at the s end, a quarter wave plate changes the linear polarization to circular polarization. Monitoring the vertical linear polarization photons at the p end will cause the quantum state collapse of the entangled target photons at the s end, and the interference fringes of the target photons become two bright fringes.

The polarization of entangled photons generated by BBO is random in all directions, the number of background noise photons is far more than that of target photons. It is necessary to connect the p and s ends to the computer for synchronous comparative analysis, otherwise the valuable information will be submerged in the noise, so that the target photons cannot be distinguished. As shown in Figure 2. Obviously, in the experiment of S. P. Walborn et al., the computer connection with the two ends of entangled photon p and s is still limited by the speed of light.

3. Technical improvement methods

3.1 Overall approach

It is the key to break through the limit of light speed that the computer at s-end can distinguish whether the target photons form interference fringes independently and immediately without connecting to p-end. The solution is discussed below.

The superposition effect of noise interference pattern and the collapsed entangled photons in the double-slit eraser interference experiment is shown in Figure 2. Based on the improved experiment methods in this paper, the effect of separating two bright fringes of noise interference pattern and collapsed entangled photons is shown in Figure 3.

Using narrow-band light filter to filter the primary laser photons which haven't generated double photons of quantum entanglement after BBO; and move the bright fringes formed by collapsed photons to the interference dark fringes location formed by the background noise.

3.2 Three-point collinear model

Adjusting the light source, the location, size and parameters of the double-slit and the screen, the bright fringes formed by collapsed photons can be moved to the interference dark fringes formed by the background noise, and the center of the two shall overlap. so that the two particle-based bright fringes produced by collapsed photons can be displayed significantly, and the fringe effect is as shown in Figure 3.

A summary of the calculation, in one case, is as shown in Figure 4,

D refers to the distance from double-slit to the screen;

b refers to the distance between the double-slit;

L refers to the distance from the light source to the two slits;

y is from the dark fringe center formed by background noise photons to the center of screen, which is also the distance between

doi: 10.18282/l-e.v9i5.2025

the center of bright fringe formed by collapsed target photons to the center of screen;

S1 refers to the light source;

θ refers to the half-angle of the light source and the double-slit.

The light source, the single slit, and the collapsed bright fringe are considered as collinear:

$y=(L+D)tg\theta$ (1)

in which y is the collapsed target photons have formed the central position of the particle bright fringes;

$y\approx(n+1/2)\lambda D/b$ (2)

in which y is the central position of the background noise dark fringes.

$L\approx(n+1/2)\lambda D/btg\theta-D$ (3)

equation (3) is derived from equation (1) and (2),

Take n = 0, and get equation (4) from equation (3),

$L\approx\lambda D/2btg\theta-D$ (4)

$y\approx\lambda D/2b$ (5)

When equation (4) is established, at this time, in equation (5) y is the central position of the first dark fringe of the background noise, which is also the central position of the bright fringe formed by collapsed target photons.

3.3 Double diffraction model

Another case is that, the center-to-center spacing of bright fringe centers after collapse is considered equal to that of the two slits; therefore b=2y, Get equation (6) from equation (2)

$b^2/2\approx(n+1/2)\lambda D$ (6)

Take n = 0 in equation (6) to get equation (7),

$D\approx b^2/\lambda$ (7)

At this time, when the screen at the position of equation (7) , the center of the first dark fringe of the background noise is also the central position of the main bright fringes formed by the collapsed photons.

3.4 Further approach

When observed at the P end, the s end is connected to the computer for counting (the computer is not connected to p). In the area of interference dark fringes formed by the background noise photons, there occur two bright fringes of the collapsed target photons, which is recorded as 1; when not observed at p, there are not two particle bright fringes at the s end, but only the interference pattern generated jointly by noise and target photons, which is recorded as 0.

As shown in Figure 5, L1 is far enough away, and S2 continuously distributes entangled photons to A and B ends. The observation at A end leads to the disappearance of interference fringes and the appearance of double bright fringes of target photons at B end, and the computer at B end can independently discover this quantum state collapse event. Multiple photon entanglement devices run at the same time, and can send multiple binary codes at a time; each device can set the pulse emission period, and continuously send signals to realize superluminal communication.

4. Conclusion

The scheme and calculation method proposed in this paper are to discuss the feasibility of superluminal transmission of information to guide verification experiments. The practical application or test can optimize the photon entanglement observation collapse scheme in this paper or explore a better implementation method.The core of the argument of this paper is that the superluminal transmission of information is not prohibited. It is theoretically and logically proved that the superluminal transmission of information is tenable and can be realized in experiment and application.

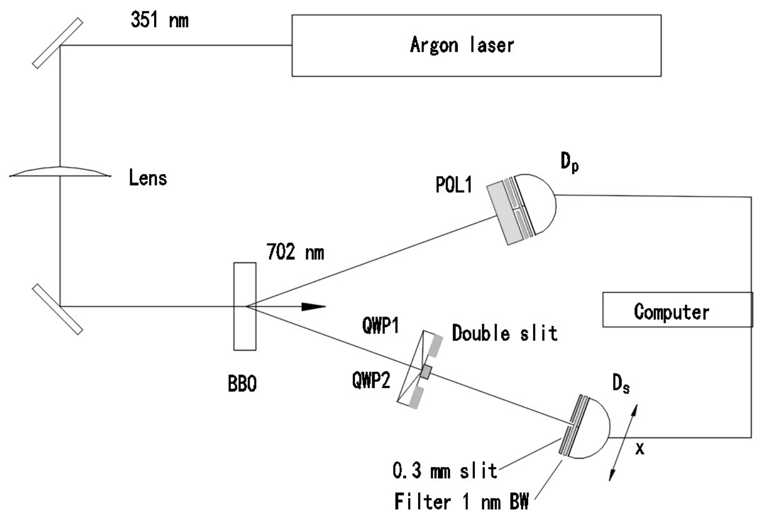

Fig. 1 The double slit quantum eraser experiment done by S. P. Walborn et al.

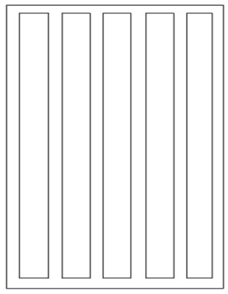

Fig. 2 The interference fringes formed on the screen without connecting the p and s ends to the computer for synchronous comparative analysis in the double slit quantum eraser experiment done by S. P. Walborn et al.

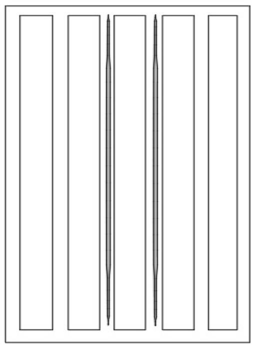

Fig. 3 The effect of separating two bright fringes of noise interference pattern and collapsed entangled photons.

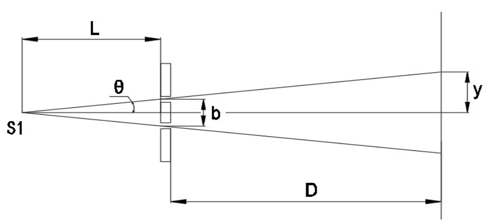

Fig. 4 The light source, the single slit, and the collapsed bright fringes are considered as collinear.

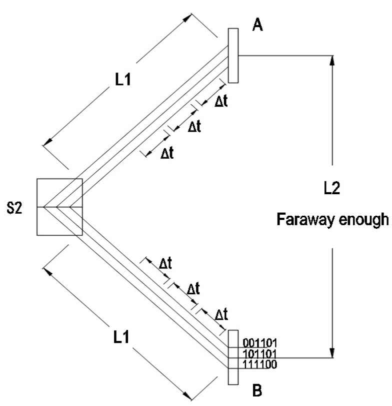

Fig. 5 Continuously send signals to realize superluminal communication.

Referencess

[1] Yin, J. Cao, Y. Yong, H. -L. Ren, J. -G. Liang, H. Liao, S. -K. Zhou, F. Liu, C. Wu, Y. -P. Pan, G. -S. Li, L. Liu, N. -L. Zhang, Q. Peng, C. -Z. & Pan, J. -W.Lower Bound on the Speed of Nonlocal orrelations without Locality and Measurement Choice Loopholes[J]. *Phys. Rev. Lett.*2013 (110), 260407.

[2] Walborn, S. P.Terra Cunha, M. O. P´adua, S. & Monken, C. H. Double-slit quantum eraser[J]. *Phys. Rev. A*. 2002 (65), 033818