

Light Strands in Slit Diffraction: Confirmatory Visualization in Media Free Environment

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ABSTRACT

The classic double slit experiment revealed fringe patterns thought to only result from wave interference. However, recent experiments revealed light stratifying into strands not waves after diffraction that can be directly visualized utilizing a water vapor cloud chamber. As vapor media particles may have interacted with light, this experiment was designed to avoid interference by utilizing a moving screen with extended photo exposure. Discrete, linear light strands were visualized after diffraction directly creating the pseudo-interference fringe pattern. Focal obstructions and hollow tubes did not demonstrate downstream reverberations. These results further support the particle theory of light and question wave concepts.

Keywords: Light Strands, Particle Wave Duality, Photons, Diffraction, Double Slit, Wave Interference

INTRODUCTION

Modern light theory has vacillated between particle and wave descriptions and dual particle-wave concepts [1-9]. The classic double slit experiment by Young was heralded as strong support for wave theory [3, 10]. The fringe pattern produced by diffracting light through a double slit (Fig. 1) [11] has been accepted as

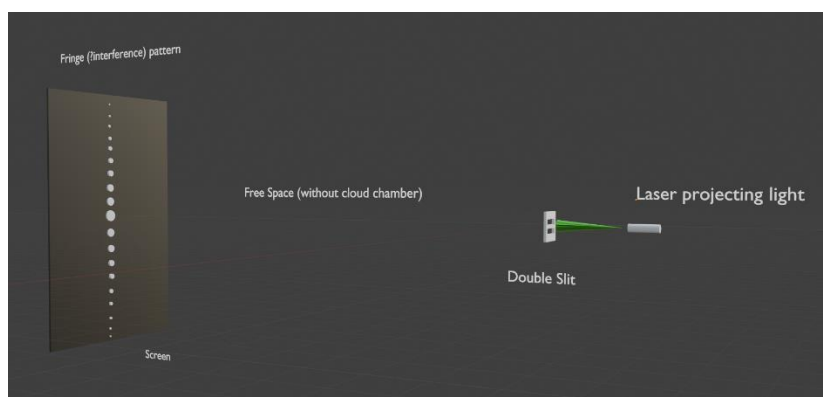


Fig. 1: Schematic rendering of Double Slit experiment with modified moveable screen

indicative of wave interference of light. Based on wave interference patterns with other media, light was assumed to behave similarly. However, when the free space after diffraction was visualized in a water vapor cloud chamber or gelatin, linear strands of light were visualized, not waves [11, 12]. A potential limitation with these studies was the presence of the water vapor

or gelatin media, whose molecules, interacting with light, may have caused the strand formation. To test this, another imaging technique using mobile screens in air and prolonged photo exposure times was employed, without the use of any viscous media, to visualize this trajectory pattern in free space.

METHODS

Double slits obtained from 3B Scientific were used in slide format with slit width of 0.15mm, and spacing of 0.30mm. A coherent light source was obtained with a laser of 532nm wavelength and 5mW output. Photographic images were obtained with Lumix DMC-ZS100 20.1-megapixel digital camera with 1 inch HD CMOS image sensor and Leica DC Vario-Elmarit 1:2.8-5.9 lens. The screen was color black card stock.

The layout of the experiment is depicted in Fig. 1. The laser source was placed on a stable platform. The double slit slide, held with a clamp, was placed in front of the laser. Upon projecting the laser light on the double slit, a fringe pattern was noted on the screen. The screen was mobile along the direction of the light trajectory. It was on a track or hand held and could move proximal to the light source or distal from it. In another iteration a focal obstruction was placed in the pathway to examine its effects. In an additional iteration a hollow plastic tube was employed to assess its effect on light pathways. In shutter priority mode, extended shutter exposure cycle of 4 secs was employed to capture time motion events. Images were taken in a darkened room and in an enclosed box to minimize stray light during prolonged photo exposure times.

RESULTS

On extended exposure images, discrete strands of light were visualized along its free space trajectory after exiting the double slit (Fig. 2). The strands streamed out in a geometric fashion, perpendicular to the slit edge. Strands remained in discrete channels and created the characteristic fringe pattern. Separation between strands created the clear intervals.

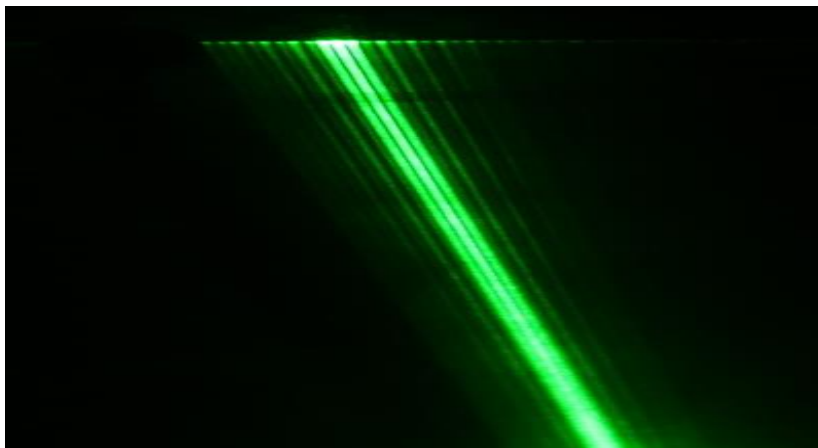


Fig. 2: Light strands visualized on extended exposure images of slit diffraction

Strands were visualized similarly when the screen came proximal to the light source and when it went distal from the light source. As the strands interact with the screen, the classic fringe

pattern is created and can be visualized along the path any time the screen movement stops or reverses (Fig. 3).

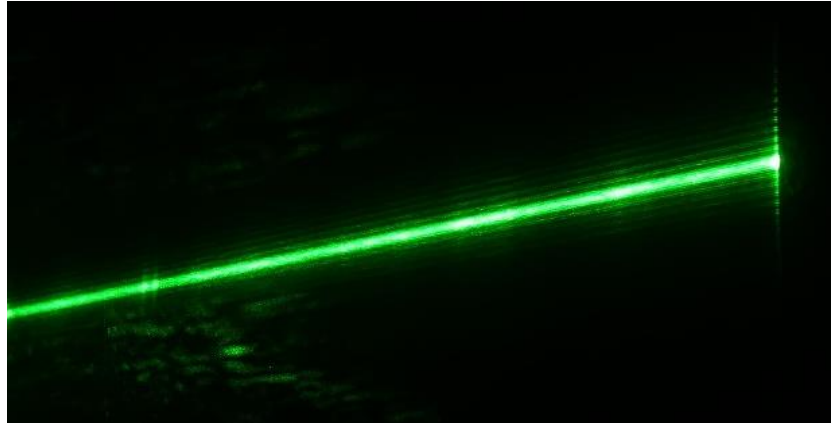


Fig. 3: Fringe patterns noted on the end screen and along the path due to stopping or reversing screen movement

Visualization of the strands could be enabled and concealed by moving the screen in and out of the light pathway respectively (Fig. 4). Fringe patterns are noted at each beginning and end screen segment.

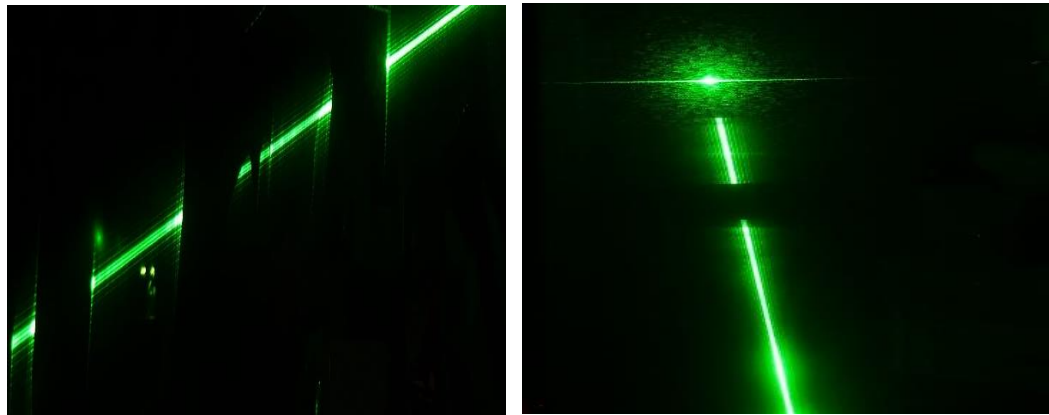


Fig. 4: Intermittent appearance of light strands on extended exposure images from intermittent screen removal

Focal obstruction was placed in the light path in one iteration of the experiment. Strands were focally blocked continuously between slit and screen and without effecting adjacent or downstream strands (Fig. 5). The blockage shadow is sharply defined with discrete edges, including within the fringe pattern without effecting the remaining pattern marks.

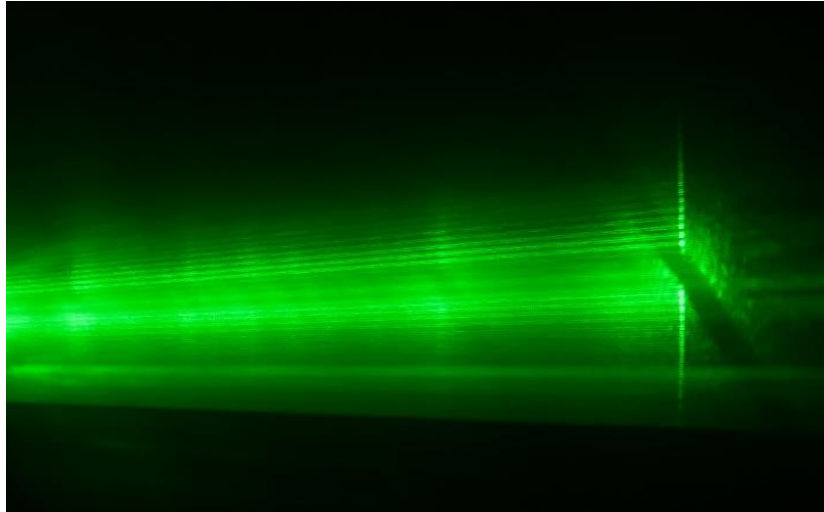


Fig. 5: Sharply defined blockage of individual light strands along the trajectory

In another iteration a hollow tube was placed in the light path. This layout did not affect the linear pathway of strands traversing inside or outside the tube (Fig. 6). No loss of strands were noted. No downstream reverberations on the light pathways were noted. The strands remained in a discrete, linear pattern throughout its trajectory. The fringe pattern is intact inside and outside the tube border on intersection with the screen other than the few strands blocked by the tube wall.

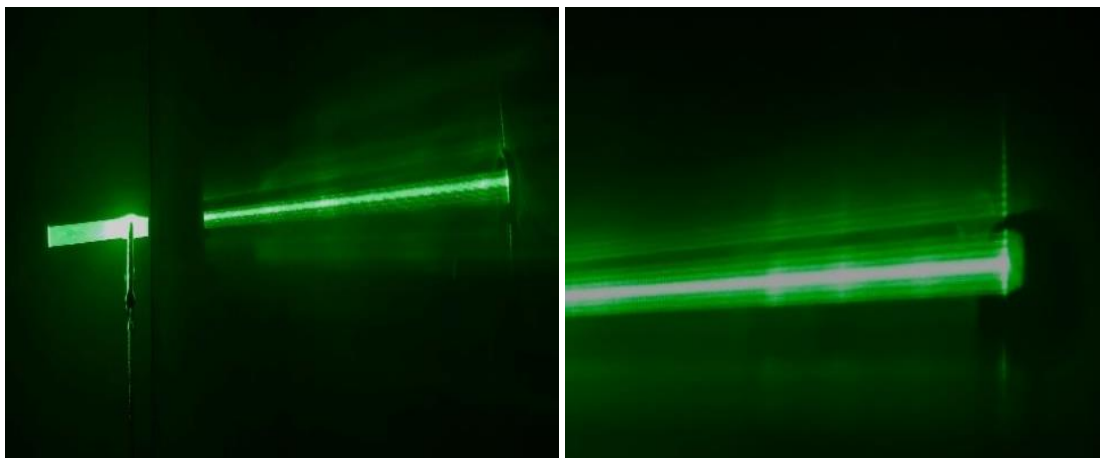


Fig. 6: Light strands traversing through hollow tube without effect on downstream or adjacent strands

A single slit diffraction was also visualized (Fig. 7). Strands were emitted but with an altered pattern of a more intense central strand and fainter peripheral ones. A correspondingly altered fringe pattern was created when interacting with the screen.

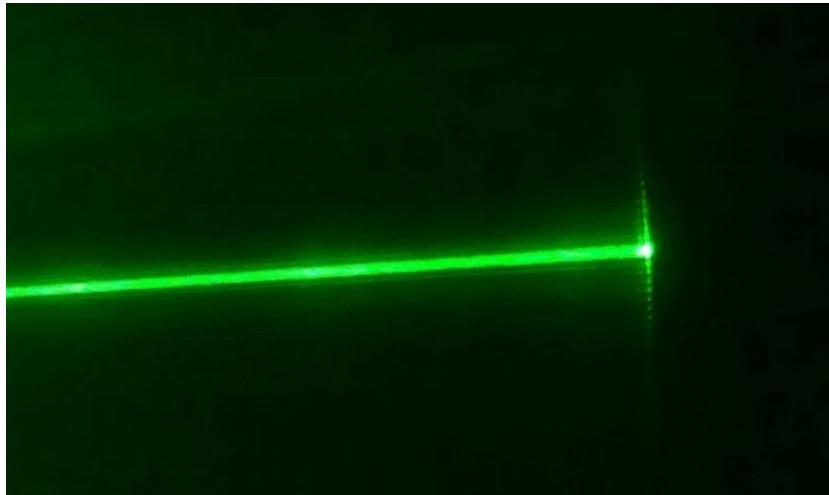


Fig. 7: Single slit diffraction creating its specific pattern of light strands and fringe pattern

DISCUSSION

The observed experimental results utilizing a moveable screen with extended photo exposure times are identical to the discrete strands with uniform angles and clear intervals that were seen in prior studies [11, 12] using a cloud chamber of water vapor (Fig. 8).

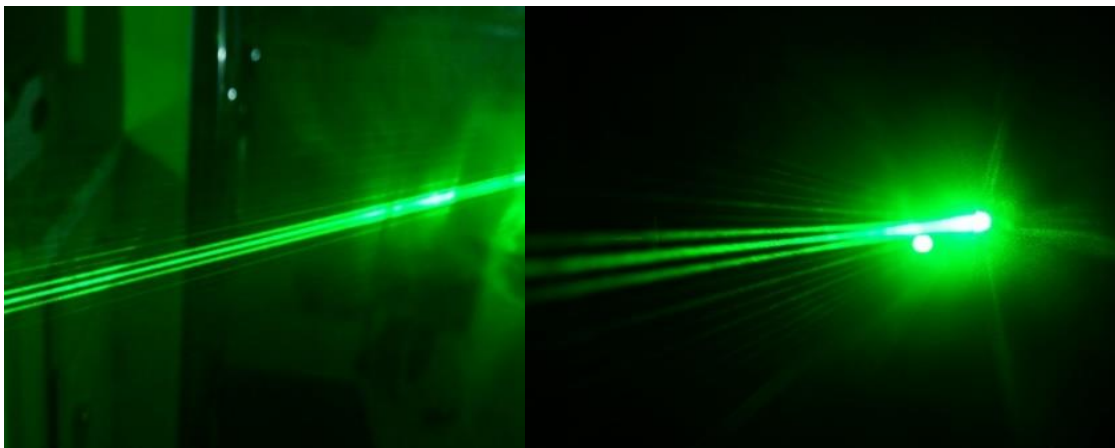


Fig. 8: Light strands visualized within a cloud chamber in double slit diffraction

Without the use of any media, investigational results mimic the same distinct strand formation seen in these prior studies (Fig. 9). These findings refute consideration of media as the cause of the strand formation.

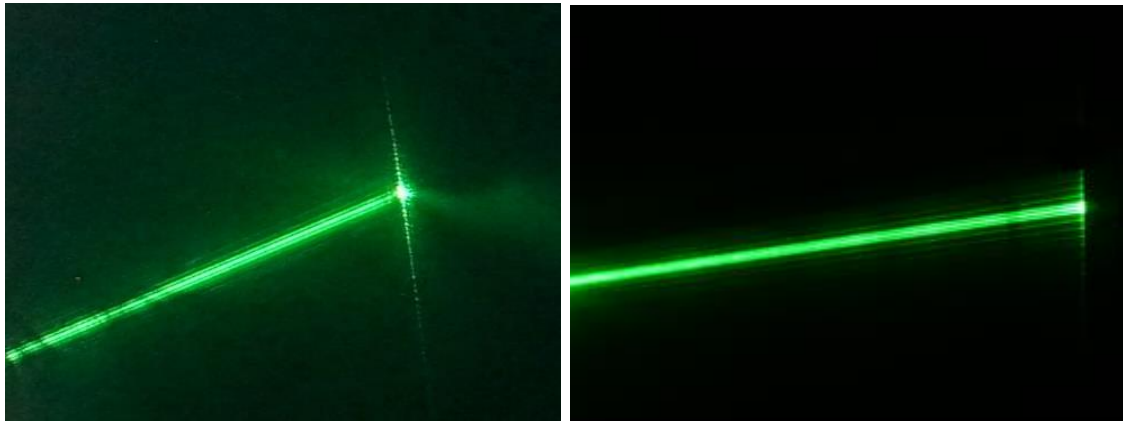


Fig. 9: Similar individual light strands creating a fringe pattern in both cloud chamber (left) and media free extended exposure images (right)

Supporting this, the fringe pattern is similarly seen being created by these discrete strands (Fig. 9) with and without media. A schematic rendering [11] demonstrates how the individual strands intersect the screen, creating the fringe pattern (Fig. 10).

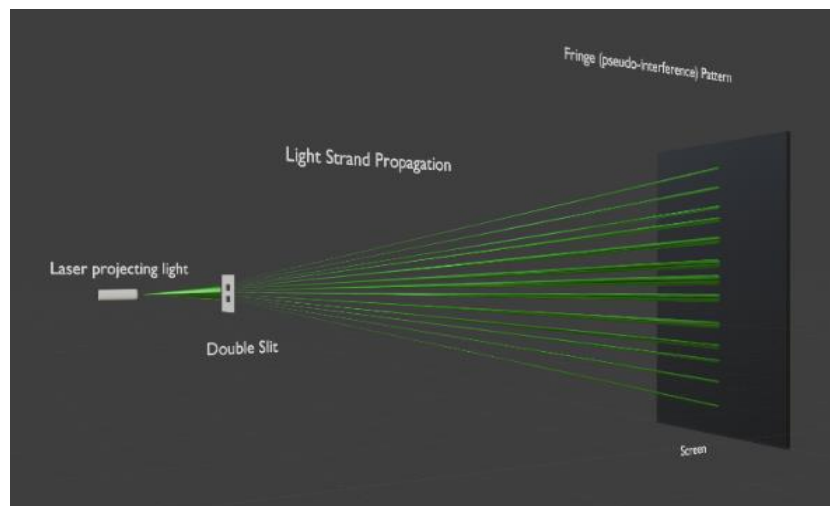


Fig. 10: Schematic representation of individual light strands intersecting with the screen and creating the fringe “interference” pattern

It is theorized in dual particle-wave theory that when light interacts with the screen it is a particle [13, 14]. Therefore, even in wave theory, as a particle visualized over time on a moving screen, light trajectory follows the same discrete, linear strand formation, not indistinct wave activity. The additional iterations reinforce this. Sharp, on and off visualization of the light strands with intermittent movement of the screen in and out of the light pathway, supports its particle nature. Light moving in waves would exhibit irregular, asymmetrical patterns and downstream effects, not sharp, discrete arrangements. Similarly, when an obstruction was placed in the light pathway, the borders of the obstruction remained discrete. There was no presence of light within the area of obstruction throughout its path and the strands adjacent to the obstruction remained aligned and well defined. In wave theory, interference would occur after the obstruction, where expanding waves would have constructive and destructive interference in altered fringe patterns. In these studies, there were no downstream

interference effects within or outside the obstruction shadow and the fringe pattern remained intact. These results are again consistent with particle behavior not waves. Correspondingly, light passed through the tube without perturbations. Strands would pass through the tube and remain discrete as they completed their path. This strongly supports particle theory, not wave theory wherein the wave interference and resulting “interference” pattern should be blocked by the tube. No downstream reverberations or changes in fringe pattern, as would be expected with waves, were noted.

Single slit diffraction also caused a breakup of light into visible strands causing a fringe pattern. This occurred with a single slit where there should be an absence of interfering waves. Most of the strands coalesced in the center with fewer peripheral strands, consistent with previously observed single slit fringe patterns [11]. This cannot be explained with wave theory as there is no generation of interfering waves from a single slit. Single electrons traversing a double slit reveal a fringe pattern over time, thought to be from wave like behavior [13, 14]. We anticipate that if the free space after diffraction is visualized, strand formations would be noted, not waves. Likewise, the delayed choice and eraser experiments may be similarly understood when their free space light pathways are visualized [15, 16].

Directly observing this phenomenon of light strands and its propagation in free space without any media is again a strong confirmation of its particle nature and counters wave theory. Downstream reverberations after encountering obstructions or cylinders, which would be consistent with wave concepts, were not present as the strands remained sharply defined. Isolated strands traversing through hollow tubes without effecting adjacent strands or its own pathway strongly supports particle behavior. Waves would be obstructed by the tube as the destructive and constructive interference would be blocked. These results also confirm how discrete light strands, not wave constructive interference, strike the screen and create the classic fringe pattern. The trajectory patterns also show that the clear spaces are not due to wave destructive interference, but are from the separation of discrete strands. This is additional visible information countering wave constructive and destructive “interference” as the sole cause for fringe marks in this setting. The fringe pattern in double slit diffraction is therefore a pseudo-interference pattern and not wave interaction. These findings encourage re-assessment of Young’s original double slit experiment that was thought to bolster the wave concept of light.

Wave behavior is not seen and is not necessary to explain the emission configuration and fringe pattern in light diffraction. Instead, these findings support light behavior as a particle that traverses in discrete strand formations. These observations first noted in a cloud chamber are confirmed to be valid and not due to media interference. Cloud chambers are suitable methods for observing light strand behavior, and the findings and conclusions from those earlier studies [11, 12] should be revisited.

CONCLUSION

Light has been shown to diffract into discrete, linear strands in prior studies using cloud chambers, but media interference was a potential confounding problem. Without using any media, this investigation was able to visualize identical light strands in air using a movable screen and extended photographic exposure times. Sustained visualization of discrete light

strand behavior through tubes and around focal obstructions further supports particle theory in contrast to wave concepts. The double slit diffraction fringe pattern is again shown to be pseudo-wave interference marks as it is visibly created by distinct light strands, not wave interaction. The conclusions and ramifications noted in prior studies of light strands should be revisited.

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