# Diffraction experiment and its STOE photon simulation program rejects wave models of light

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**Abstract**

The interpretation of Young's double slit experiment of diffraction and interference remains controversial. The Scalar Theory of Everything (STOE) model of single photon diffraction is a model with photons being directed by plenum forces as Newton speculated. The STOE simulation of the light diffraction experiments produces the Fraunhofer diffraction pattern on the screen. An experiment used an image resulting from a single slit projected onto a second mask. If the second mask slit is placed at the center of the image, a Fraunhofer diffraction pattern is projected onto the screen. One side of a slit in the minima examined the result of varying the intensity of the illumination across the slit. One slit of two in the minima examined the result of only one of the double slits being illuminated. The resultant patterns on a screen were photographed and are on the opposite side of center from the illuminated side of the second mask. The STOE simulation reproduced the images. The STOE explains several quantum peculiarities with classical processes. These observations do not reject the Newtonian model of diffraction and does reject wave models.

Diffraction, Interference, Young's experiment, Afshar's experiment, Newton Interpretation, Theory of Everything, STOE. PACS 42.50Ct, 42.25Hz, 42.25.Fx

## 1 INTRODUCTION

A single model of light has remained a mystery. Black body radiation, the photoelectric effect, and the Compton effect observations reject the wave-in-space models of light. The reflection, diffraction, interference, polarization, and spectrographic observations reject the traditional particle models of light. Explaining the behavior of light as particles reduces to explaining just one experiment, Young's double slit experiment conducted in 1801.

Physics in the Newtonian and cosmological scales revolve around the concept that the motion of a single particle can be modeled with forces acting on the particle. The challenge of uniting the Newtonian and quantum worlds is to

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develop force laws of motion of photons that obtain the diffraction experimental observations.

Scientists in Newton's time knew of diffraction effects. Opticks (1730) speculated light was a stream (ray) of particles. The wave in the aether in query 17 overtakes (travels faster than) the rays of light and directs the rays' (corpuscles') path. Newton's analogy was of water waves. That is, Newton was using a self-similarity (fractal) postulate. The particles of light recede from denser parts of the aether in query 19. The aether grows denser from bodies in query 20 and this causes gravity in query 21. Newton seems to have suggested light is particles that are directed by the divergence of the aether and that produce the wave phenomena in the aether. Starting with Young's experiment, the prevailing models of the 19th century considered light to be a wave. The prevailing interpretation of Newton's model is that Newton was suggesting light is both a wave and a particle. However, he thought of light as two entities having differing effects like a rock (photon) creating waves in water (aether).

Query 21 may be interpreted as the General Relativity concept that matter warps the gravitational aether (now known as "space") and the gravitational aether directs matter. Therefore, Newton seems to be suggesting a possible single model to unite cosmology and quantum mechanics. All that is needed is to explain Young's experiment with aether and particles. Note that Newton's model is deterministic and is inconsistent with decoherence models.

The Newtonian interpretation of quantum mechanics is: that matter causes the aether decline in a $1/r$ fashion, that the moving matter causes waves in the aether, that the "diffraction" pattern is in the aether waves, that the aether waves travel much faster than matter (faster than light), that the slope of the aether directs matter, that the wave may be reflected by matter, and that the Schrödinger equation describes the energy evolution of the real, aether waves.

Several models have been developed that describe the intensity pattern of light on the screen. Young noticed in his diffraction experiment that the slit edges appear luminous (Jenkins and White 1957, p.379). Therefore, his model consisted of the interference of the waves assumed to originate at the edges and of the direct wave. Fraunhofer, Fresnel, Sommerfield and Kirchhoff models assumed the waves originated before the slit and the diffraction occurred in a plane across the slit. These models depended on the Huygens-Fresnel principle that stated each point along the wave crest is a source of a new, spherical wave. Because this was inconsistent with wave observations in the classical domain that waves are emitted in all directions from a source, an ad hoc postulate that the wavelets were not emitted backward had to be made. The points on the wave in the plane of the slit produced the diffraction pattern. These models were poor close to the slit (Jenkins and White 1957, Section 18.17). Some models were better close to the slit but degenerated into the Fraunhofer equation farther from the slit.

The Scalar Theory of Everything (STOE) proposed a model of the photon and its dynamics (Hodge 2015) from Newton's speculations. The result was a computer simulation model with forces acting on photons. It produced a good correlation with the Fraunhofer equation far from the slit, explained why the

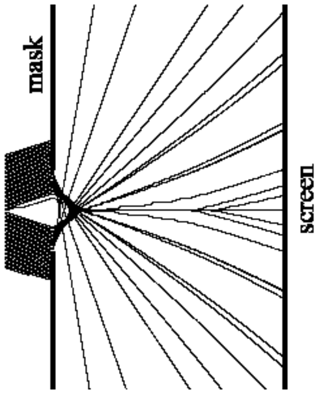


Figure 1: Plot of the trace of the paths of photons for a sample of the photons through the single slit mask according to the STOE simulation.

current models fail close to the slit, and is consistent with Young's observation of illumination coming from the edges.

The inconsistency with other models is seen in the path of the photons close to the slit edges (see Fig. 1). The crossing pattern seen in Fig. 1 is inconsistent with the fan pattern of spherical waves of the Huygens-Fresnel principle. They cross the centerline of the slit to form the image on the opposite side of center. All other models suggest the waves or photons fan out from the slit such that photons/waves through the left side of the slit form the left side of the image or fan out over the entire image. This suggested the present experiment.

In this paper section 2 describes the experiment and the results for slits. Section 3 show the results for edge experiments. The discussion is in section 4 and conclusion is in section 5..

# 2 The experiment

Introducing a second mask was used to achieve coherent photons through one side of a slit. Figure 2 shows a diagram of the experiment. The second mask was shown to produce the diffraction and interference patterns of standard experiments. This establishes a "control" in the experiment such that no additional fixtures to "collapse the wave function" are required. Next the second mask was shifted to allow light to vary across the slit.

The laser was a 635nm, 5 mW laser pointer. The second mask was 157 cm from the first mask. The first mask slit was 1 mm wide and was 10 cm from the laser. The second mask single slit was 2 mm wide. The second mask double slits were 0.5 mm wide and 2 mm between centers. The distance to the second mask was determined such that the image of the first slit covered the second mask slit from the maximum to the first minimum. The screen was 638 cm from the second mask.

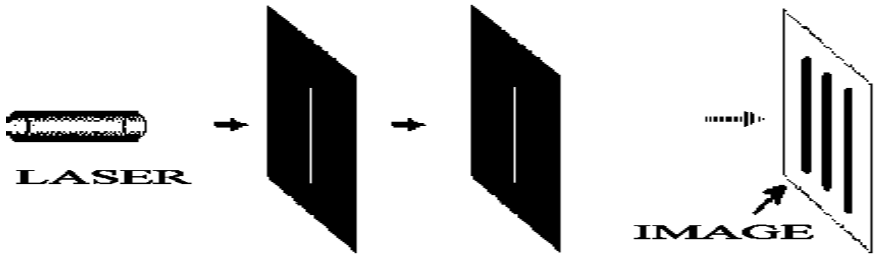


Figure 2: Diagram of the experimental fixtures.

Figure 3(TOP) shows the diffraction pattern for a single slit from the first mask. The figure was converted to two colors for printing. Each fringe shows as a band of bright light with dimmer light between the bands on a screen. The minima have very little light intensity at the minima.

Figure 3(TOP) shows the placement of the slits relative to the image of the pattern from the first mask. "Slit pos. 1" is the control to show the light impinging on the second mask is coherent and is according to previous observation.

The Fig. 3(BOTTOM) shows the screen pattern result. This is another pattern like the first. It shows the light through the second mask is coherent as expected. The pattern shows the fringes slightly closer because the second mask is closer to the screen than the first mask.

The input intensity $I(x)$ is the number of simulated photons released at a point $x$ along the X–axis that is parallel to the simulated mask. This is shown on the extreme left in Fig. 1 as a constant intensity across the slit. The average counts $\bar{B}(x_s)$ in a bin along the screen $x_s$ is defined in Hodge (2015). The simulation is well fit by the Fraunhofer equation with a 97% correlation coefficient.

The top image of Fig. 5 shows the placement of the second mask slits partly over the minima of the first mask image. The goal is to have a large difference between the intensity on one side of the slit and the intensity on the other side. The bottom image is the photograph of the result on the screen. Most of the light enters the slit on the left when viewed from the laser. The image is on the right and it is a diffraction image. Note the placement of the secondary fringes on the right match the right side fringes of the Fraunhofer diffraction pattern. The image on the left was too faint for the camera to capture. The left part was diffuse (no clear diffraction pattern).

Figure 6 shows the simulation of the Fig. 5 experiment. The vertical line marks the center of the slit on the screen. Note the smaller intensity on the left, which may be a diffraction pattern.

Figure 7 shows the $I(x)$ of this simulation. The Fraunhofer equation used in the figures is:

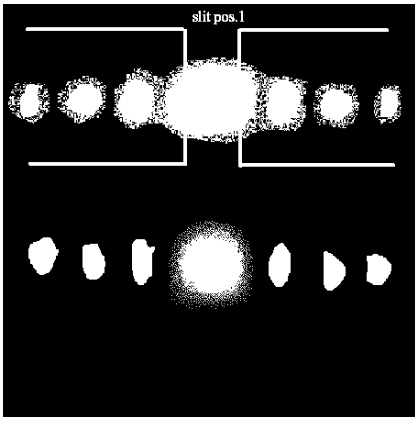


Figure 3: Photograph converted to 2-color shows (top) the diffraction pattern through the first slit and the placement of the second mask slit that produces the (bottom) diffraction pattern in the screen.

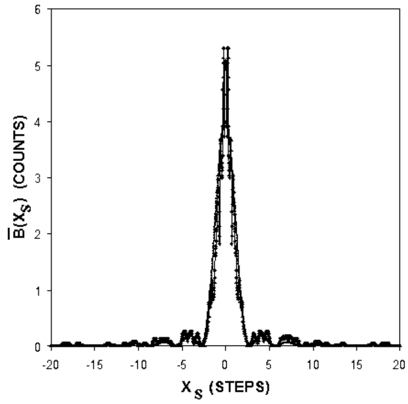


Figure 4: The simulation of the slit over the fringe from the placement of slit of Fig. 3. The solid line is the best least squares fit of the Fraunhofer equation.

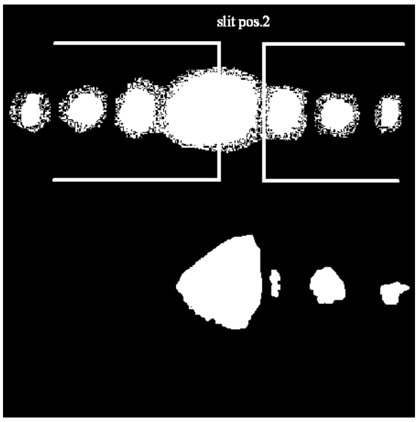


Figure 5: The top image shows the placement of the second mask slits relative to the first mask image. The bottom image is the photograph converted to black and white result on the screen.

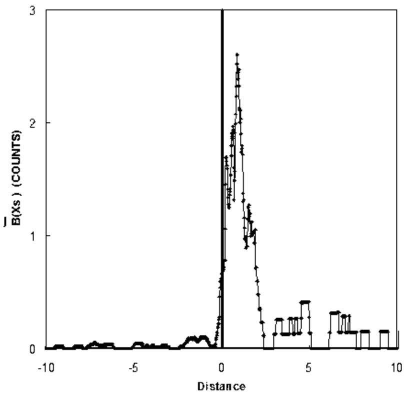


Figure 6: The simulation of the slit over the minima from the placement of slit of Fig. 5. The vertical line marks the center.

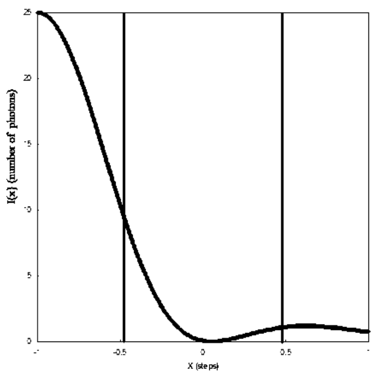


Figure 7: Plot of the $I$ of photons vs the distance across the slit. The "0" is the center of the slit in the simulation.

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$$I(x) = I(x_0)\frac{\sin^2 \beta_d}{\beta_d^2}, \tag{1}$$

where $\beta_d = K \sin(\theta(x))$, $\theta(x) = ATAN(x/L)$, $x$, and $L$ are defined in Hodge (2015), $x_0$ is the position of the maximum, and $K$ determines the width of the screen diffraction pattern. The vertical lines mark the slit edges.

The top image of Fig. 8 shows the placement of the slits on the first slit image for a double slit experiment. The middle image had an exposure to show the double slit interference pattern. The bottom image had an exposure to detect the outer fringes.

Most of the light entered the left slit. The image is on the right and it is a double slit diffraction image.

Figure 9 shows the simulation of the Fig. 8 experiment. The $I(x)$ was the same as in Fig. 7 except the slits were placed for the double slit experiment. The "0" marks the center of the slit on the screen. Note the smaller intensity on the left, which may be in a diffraction pattern.

# 3 Edge experiments

The equipment and performance of this experiment is the same except the second mask is an edge rather than slits. Figure 10 is a diagram of the experiment.

Figure 11 shows the placement of the edge relative to the diffraction pattern from the first mask (top) and the image on the screen (bottom). Figure 12 is the result of the simulation of this edge configuration.

Figure 13 and Figure 14 shows the input to the simulation for Fig. 11 and Fig. 15, respectively.

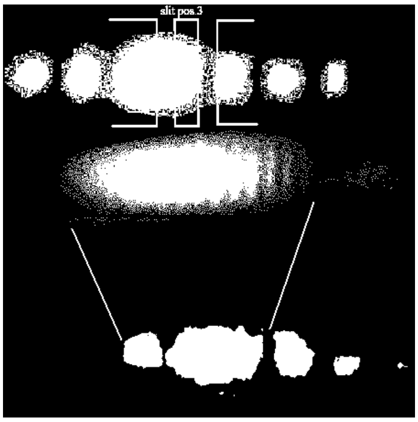


Figure 8: Photographs converted to two color of images. The top image shows the placement of the double slits on the first slit image. The middle image had an exposure to show the double slit interference pattern. The bottom image had an exposure to detect the outer fringes.

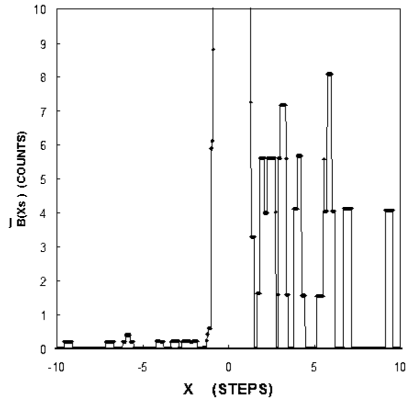


Figure 9: The simulation of the double slits over the minima from the placement of slit of Fig. 8. The "0" marks the center.

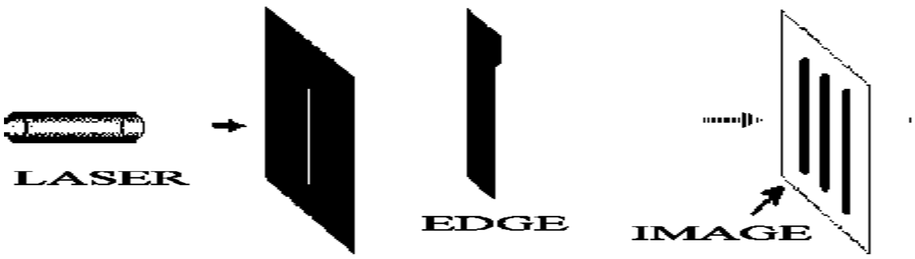


Figure 10: Diagram of the experimental fixtures.

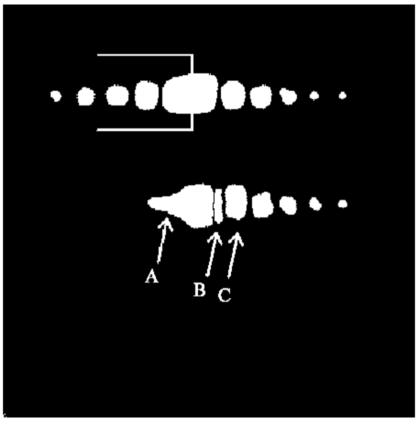


Figure 11: (TOP) The placement of the edge relative to the diffraction pattern from the first mask. (BOTTOM) The image on the screen.

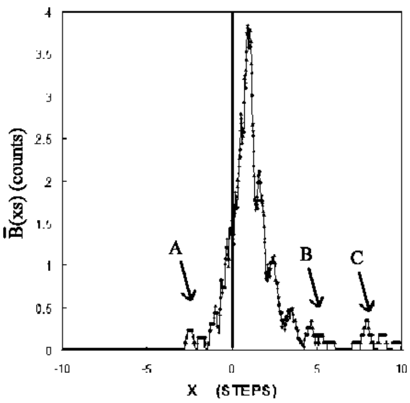


Figure 12: The result of the simulation of this edge configuration. The “A”, “B” and “C” are the image points in Fig. 11.

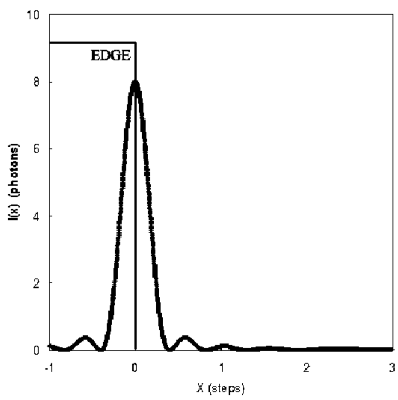


Figure 13: The input to the simulation for Fig. 11. The curve is a plot of the Fraunhofer equation.

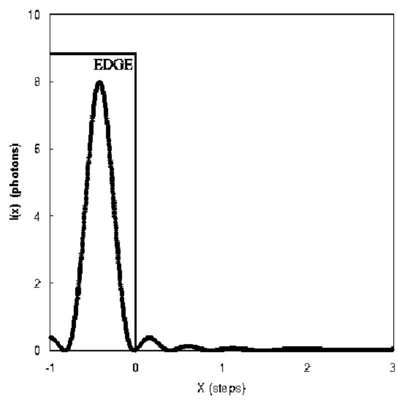


Figure 14: The input to the simulation for Fig. 15. The curve is a plot of the Fraunhofer equation.

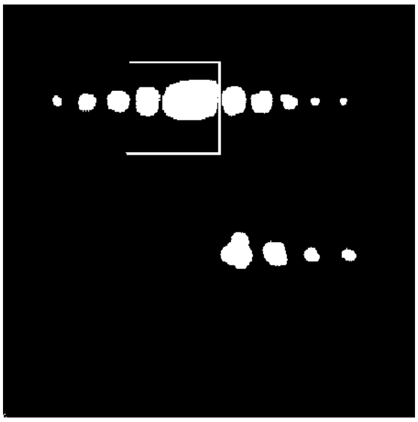

Figure 15: (TOP) The placement of the edge relative to the diffraction pattern from the first mask. (BOTTOM) The image on the screen.

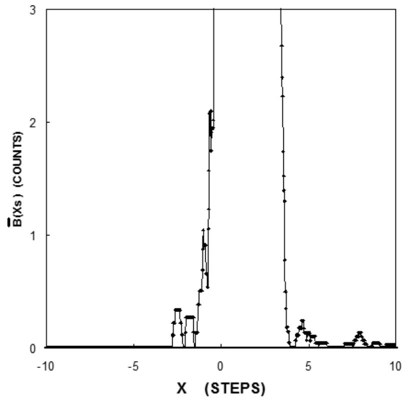


Figure 16: The result of the simulation of this edge configuration.

Figure 15 shows the placement of the edge relative to the diffraction pattern from the first mask (top) and the image on the screen (bottom). Figure 16 is the result of the simulation of this edge configuration.

# 4 Discussion

The placement of the second mask in relation to the minima is difficult. The reproduction of the exact images is, therefore, difficult. The important point is that the diffraction image appears more intense on the opposite side of the illuminated part of the slit.

This model started with a theoretical development from cosmological considerations. The mathematics was developed to produce the trace of the paths of photons in Fig. 1. Then this experiment was devised to show a difference between the standard wave models and the STOE. This is prediction in the best tradition of theoretical physics.

The Newtonian model does not require the Huygens-Fresnel principle. The Newtonian Interpretation includes the reflection of plenum (aether) waves by matter like ocean waves reflected from islands. This combined with faster than light wave speed suggests considering the $\Psi^*$ of the Transaction Interpretation is a reflection wave. This explains the concept that “observation” changes the experiment. That is, the introduction of equipment changes the reflection pattern. The reflection of plenum waves model yielded a 97% correlation coefficient between the simulation and the Fraunhofer equation.

Because the screen pattern changes with the photon intensity distribution, the photon causes the waves. Any model that uses the Huygens-Fresnel principle cannot produce the observed distribution. Single photon (Afshar et al. 2007) experiments suggest the waves that influence the photon must be reflected back to the photon.

The "walking drop" experiments also show a diffraction pattern of a single drop in the experiment at a time. When the drop is between the mask and screen, part of the waves in the medium reflect off the mask and part go through the slit to disappear from influence.

The STOE model provides a link with General Relativity - matter warps the "space" (gravitational ether, plenum) and "space" directs matter.

The STOE model also provides a link between the classical world and the quantum world. The STOE model assumes waves behave as observed in the Newtonian / classical world. The Huygens-Fresnel principle has the assumption the source point on a wave crest radiate in only the forward direction and not backward. The directional radiation from points is inconsistent with observations in the Newtonian world. Waves translate not reradiate.

These experiments avoid some of the potential objections to the interpretation of the Afshar Experiment such as the wires collapse the wave function and the existence of the interference pattern in the plane of the wires is inferred rather than experienced (no measurement). However, The STOE model allows the waves to reflect off the wires that alter the plenum field. If the wires are small, this alteration is small.

The resulting mathematics of the STOE model is the same as the end result mathematics of the Fraunhofer model. The difference is the derivation of the STOE model uses observation from the classical world such as the generation and reflection of waves. The derivation of the Fraunhofer model uses assumptions not experienced in the classical world such as the "obliquity factor" and the advance of 1/4 period ahead of the wave that produces the waves.

# 5 Conclusion

The STOE model (Newtonian Interpretation) simulation is consistent with diffraction experiments.

The Huygens-Fresnel principle is inconsistent with the observations in these experiments. Therefore, these experiments falsify the Huygens-Fresnel principle and the wave models based on it. That is, all wave models of light are falsified.

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