STOE simulation of photon spectrographic behavior

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Abstract
Spectrographic behavior of light has been attributed to the wave model of light. The Scalar Theory Of Everything (STOE) model of light suggests photons are composed of hods that are one of the two components of the universe. The Hodge diffraction experiments rejected the wave models of light. The Fraunhofer pattern of coherent light on a screen from a slit in a mask is compared to the STOE computer simulation of spectrographic effects. The number of hods serves the same place as the frequency (energy) of light. Thus, the energy of light is proportional to the number of hods in the photons. An additional hod in a photon adds Planck's constant amount of energy to the photon. Therefore, the STOE incorporates spectrographic observations.

keywords: Diffraction, Light, photon, STOE, spectrum

1 INTRODUCTION
Coherent light such as from a laser shown through a slit produces a diffraction pattern on a distant screen such as in Fig. 1. When a uniform intensity of light passes through the slit, the Fraunhofer equation is a close description to the intensity pattern on the screen. The Fraunhofer equation relates the intensity $I$ at a point on the screen to the frequency $\lambda$ of the light, to the slit width $b_f$, and to the angle $\theta$ from the centerline of the experiment to the point on a screen from the slit:

\begin{align*}
I &= I_0 \frac{\sin^2 \beta_f}{\beta_f^2} \\
\beta_f &= \pi \frac{b_f}{\lambda} \sin(\theta) \\
\theta &= \arctan \left( \frac{x_f}{L_f} \right) ,
\end{align*}

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where $I_{fo}$ is the maximum intensity of the pattern, $x_f$ is the distance on the screen from the center of the principle peak of the pattern to the point being evaluated, and $L_f$ is the distance from the mask to the screen.

The minima occur when $\beta = \pm m\pi$ where $m$ is an integer. The $\lambda$ dependence suggests the diffraction effect exhibits spectrographic characteristics of light.

The Scalar Theory Of Everything (STOE) developed a model of light (Hodge 2012). This photon model and a simulation program were developed to yield a diffraction pattern after passing the simulated photons through a slit. The STOE model reduces to the Fraunhofer like model when a large number of photons are simulated through a slit. The screen image matched the Fraunhofer pattern when a uniform distribution of photons passed through the slit. This model was applied to single photon experiments (Hodge Experiments) that rejected all wave models of light when a non-uniform distributions passed through the slit (Hodge 2015a,b,c, 2017).

The intensity of photons on the screen in the simulation is similar to Eq. 1:

$$I = I_{fo} \frac{\sin^2 \beta_s}{\beta_s^2}$$

$$\beta_s = \pi Nb_b K_s \sin(\alpha)$$

$$\alpha = \arctan(\frac{x_s}{L}),$$

where $N$ is the number of hods in the photon simulation, $b_b$ is the simulated slit width, $x_s$ is the simulated distance on the screen from the peak of the pattern to the point being evaluated, $L$ the simulated distance from the mask to the simulated screen, and $K_s$ is the constant.

This Paper relates the simulated parameters to the actual diffraction experiment parameters. The experiment with lasers is discussed in section 2. The simulation experiment is discussed in section 3. The Discussion and Conclusion are in section 4.
2 The experiment with lasers

At the first \((m = 1)\) minima,

\[
\sin(\theta_1) = \frac{\lambda}{b_f},
\]

and \(x_f = W_{c1}/2\) where \(W_{c1}\) is the distance from the first minima on one side of the central peak to the first minima on the other side of the central peak as shown in Fig. 1. The \(\lambda\) dependence suggests the diffraction effect exhibits spectrographic characteristics of light.

Figure 2 shows the result of plotting the \(\sin(\theta_1)\) versus \(\lambda/b_f\) for a sample of diffraction experiments. The \(\lambda\) used were 650\(\pm\)10 nm, 635\(\pm\)10 nm, 532\(\pm\)10 nm, and 408\(\pm\)10 nm of commercially available laser pointers. The \(b_s\) were 0.813 mm, 0.711 mm, 0.610 mm, 0.508 mm, 0.406 mm, 0.305 mm, and 0.203 mm. The \(L = 7724\) mm. The straight line is:

\[
\sin(\theta) = 1.08(\lambda/b_s) + (3.92 \times 10^{-5}),
\]

where the standard deviation is 0.0008 and the correlation coefficient is 0.99+.

At the second \((m = 2)\) minima,

\[
\theta_2 = \arctan\left(\frac{x_{f2}}{L_f}\right),
\]

\[
\sin(\theta_T) = \frac{\lambda}{b_f},
\]
where $x_{f2} = W_{c2}/2 + W_{c2}$ and $W_{c2}$ is the distance from the first minima on one side of the central peak to the second minima as shown in Fig. 1. For the small angles, $\sin(\theta_1) \approx \theta_1$ and,

$$\theta_2 = \theta_T - \theta_1.$$  \hfill (7)

$$(\theta_2) = 1.02(\lambda/b_s) - (1.5 \times 10^{-5}).$$  \hfill (8)

where the standard deviation is 0.0007 and the correlation coefficient is 0.99+.

3 The simulation experiment

Equation 2 has a minima when $\alpha = \pi$. Solving Eq. 3 yields:

$$\sin(\alpha_{|\text{minima}}) = K\frac{1}{Nb_s},$$  \hfill (9)

where $|\text{minima}$ means to evaluate the parameter at the respective first minima of the pattern and the constants are included in the proportionality constants of the parameters.

Figure 4 shows an example of the simulation’s screen pattern for $N = 10$ and $b_s = 0.22$ step. Several simulation runs were made with $N$ equal to 7, 8, 9, 10, 11, and 12. The $b_s$ was equal to 0.44 step, 0.54 step, and 0.64 step. Figure 5 shows the plot of $\sin(\alpha)$ versus $1/(Nb_s)$. The straight line is:

$$\sin(\alpha) = 0.18/(Nb_s) + 0.02.$$  \hfill (10)
4 Discussion and Conclusion

The Fraunhofer pattern of coherent light on a screen from a slit in a mask is compared to the STOE computer simulation of spectrographic effects. The number of hobs serves the same place as the frequency (energy) of light. Thus, the energy of light is proportional to the number of hobs in the photons. An additional hob in a photon adds Planks constant amount of energy to the photon.

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