Experiment 8 Double Slit Interference and the Wavelength of Light

William Wagner

Alex Yeoh

We used a phet to measure the time it takes for 20 oscillations of a specific color of light to calculate the wavelength of that light. We then used the phet to measure the distance various maxima are from the central maximum when the light goes through two slits at different positions to calculate the wavelength of the light. The two ways of calculating the wavelength of light generally agreed, but for both green and red light, part C was always far above the expected wavelength enough to be considered a different color (in the case of green light)/spectra (in the case of red light).

**Results:**

State whether, or not, that the wavelengths determine for the green light using interference are in agreement with the wavelength determined by using the period. Look up the range of wavelengths for green light and compare with your values. Repeat for the red light.

The wavelengths determined for green light through interference and period seem to agree except for part C which has a much larger calculated wavelength than the rest. The calculated green wavelengths seem to imply that the color is actually on the higher end of the cyan color because the calculated wavelengths were lower than the 520 to 560nm wavelength of green light, except for part C which implied that the light was actually on the higher end of the possible wavelengths of green light.

The wavelengths determined for red light through interference and period seem to agree except for part C which has a larger calculated wavelength than the rest. The calculated red wavelengths seem to imply that the color is red color because the calculated wavelengths were in the 635 to 700nm wavelength of red light, except for part C which implied that the light was actually just over the red boundary of 700nm and into the infrared spectrum.

**for Discussion:**

1. Describe what happened to the interference pattern (either for green light, or for red light) when the barrier distance was changed. Was there a change in the wavelength determined using this new barrier position from the initial barrier position? If so, what may have caused this?

For green light, the increase in barrier distance reduced the number measurable waves on the screen and increased the distance of waves from the central maximum. There was a slight change in wavelength determined due to barrier position, but this is likely due to human error when determining where the peaks of each wave are on the graph.

1. Describe what happened to the interference pattern when the slit positions were changed. Does this go along with the equation for the interference? Was the effect more pronounced for the red light, or for the green light? Why did this happen?

Increasing the distance of the slits increased the number of waves measurable and also decreased the distance each wave was to the central maximum. This was more pronounced for the green light because green light has a higher frequency.

1. Using the wavelength determined for the red light and a separation of slits equal to 1600 nm, what is the maximum number of fringes (interference lines) that can be generated? Do this also for the green light wavelength.

Maximum would have an angle of 90 because sin(90)=1, p=d\*sin(90)/λ=d/λ but this only accounts for one side and doesn’t account for the central maximum, so the total maximum would be p=2d/λ+1

Red: 6.6471E-07nm  
2\*1600/6.6471E-07=4.8141E+09 fringes

Green: 5.0931E-07nm  
2\*1600/5.0931E-07=6.2830E+09 fringes

1. What kind of interference is occurring at the positions of maxima in the interference pattern? Describe this type of interference. What kind of interference is occurring at the positions of minima in the interference pattern? Describe this type of interference.

Constructive interference is happening at the positions of maxima, this happens when the crests/troughs of multiple waves overlap making it seem as though there is a single much larger crest/trough. Destructive interference is happening at the positions of minima, this happens when the crests and troughs of multiple waves overlap making it seem as though there is a single much smaller crest/trough or potentially even no wave at that point.