Riverside Community College

Physics 4-C

LABORATORY REPORT 7

Laser and double slit!

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Professor

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Date of experiment : 04/24/2024

1 Introduction

This lab's goal will be to experimentally measure the wavelength of a red laser using the double slit experiment. As well as experimentally finding the aperture of the slits.

2 Methodology

We will use four different double slit configurations from a diffraction wheel. The process of measurements should be the same for all four experiments.

2.1 Setup

1. We utilized a PASCO metallic rail 1.6 meters in length where the measurements are marked on the rail.Also used was a laser beam from PASCO, a wheel with double slits, and a plastic board from PASCO.

2. Measure the distance from the laser to the plastic board, we found this to be 2.9 meters.

3. Position the laser so it can be seen on the board.

4. Measure the distances between the slits d for all four configurations of the double slits from the wheel.

5. Turn off the lights.

2.2 Procedure

What double slit you use should not change the procedure as it is identical for all double slits you will use in this lab. Note that the measurements going on will be in millimeter.

1. Turn the wheel until you get one of the double slits, the one you start with doesn't matter, just make sure you are switching them each run.

2. Count any number of bright spots or other words constructive interference n) and measure this distance between the starting point and the end point (y_n).

3. Now Measure the points of destructive interference, or the dim parts.

4. Repeat for three other double slit experiments

3 Data

Tabulating our values

D(mm)	Y_n (mm)	d (mm)	Y_d(mm)	n	λ (mm)	a (mm)
2900	17	0.5	52.0	4	0.000733	0.017931
2900	31	0.2	53.0	4	0.000534	0.018276
2900	39	0.5	102.0	10	0.000672	0.035172
2900	45	0.2	119	5	0.000621	0.041034

4 Analysis

4.1 Calculations

1. In order to measure the wavelength of the red light we would need to use the equation for Constructive interference $d \sin \theta_n = n\lambda$
2. We find that $\sin \theta_n = \frac{y_n}{D}$, where y_n is the distances from the bright spots.
3. Substituting $\sin \theta_n$ to get $d\frac{y_n}{D} = n\lambda$
4. Solving for the wave length yields $\lambda = \frac{d(y_n)}{n(D)}$
5. Then to find the aperture of the slits you would use the aperture equation,$a = \frac{y_d}{D}$ where in this case we have how far the dark spots are over the distance from the board to the laser.

4.2 Interpretation

Averaging the λ for all four double slit experiments, we can find the average value of λ . From this average we averaged this value with our colleagues who attended the 4/24/2024 lab.

5 Result

We found our apertures to have a value of 0.018 mm , 0.018 mm , 0.035 mm , and 0.041 mm . Our average wavelength for the red light was 640 nanometers.

6 Conclusion

With this experiment we experimentally determined that the wavelength of red light. Which itself is a feat as we are measuring something that is in nanometers, 10 to the -9 meters!

One thing to note with our data is that there might be slight discrepancy's as the distance measured with the calipers were extremely small!

7 References

[1] Dr. Russel's Lecture 4/22/24, Riverside Community College.

Special thanks to my Grandma for making me breakfast before this lab!