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Group: _____

$$d\sin(\theta_{bright}) = m\lambda$$
$$y_{bright} = m\lambda L/d$$
$$d\sin(\theta_{dark}) = (m+½)\lambda$$

Lab 11 – Interference/Diffraction

Complete this lab worksheet and turn it in for credit. Show all your work including the calculations you performed (attach additional sheets if necessary).

11.4.1

$L = 42m \rightarrow 4200cm$

1. Read section 11.4.1 of the lab book. Summarize the procedure for obtaining the distance between slits, *d*.

You start by familiarizing yourself with the proper way of reading the microscope. Then you will angle the desk lamp to work as your backlight so you can measure the two slits with the biggest distance of each other. Place a piece of paper under the petridish and turn the wheel in one direction either right or left. Use this to measure the distance from one slit to the other. Then rinse and repeat for the other data.

2. Use the images provided to fill in the table. **Include units** in your measurements.
A B

L_1

R_1

L2

R2

cm	Set A	Set B
L_1	3.082cm	4.46cm
R_1	3.103cm	4.475cm
L_2	3.033cm	4.553cm
R_2	3.053cm	4.58cm

3. Compute the slit distance, using eq. 11.7 and 11.8 in the lab manual. Show your work (You may attach extra sheets if need be).

CM	Set A	Set B
L_1	3.082cm	4.46cm
R_1	3.103cm	4.475cm
L_2	3.033cm	4.553cm
R_2	3.053cm	4.58cm

$\frac{|L_2-L_1|+|R_2-R_1|}{2} = \frac{|3.033-3.082|+|3.053-3.103|}{2}$

$d_A =$ 0.0495cm

$d_B =$ 0.1065cm $\quad \frac{|L_2-L_1|+|R_2-R_1|}{2} \rightarrow \frac{|4.553-4.46|+|4.58-4.461|}{2}$

$\rightarrow \frac{0.093+0.12}{2}$

$\rightarrow \frac{0.213}{2}$

11.4.2

1. Read section 11.4.2 of the lab book. Summarize the procedures for this experiment.

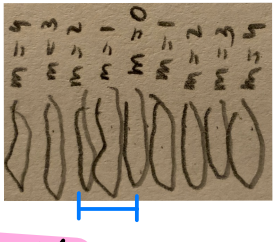
A laser is setup at one end of the system 4m away from the wall at a minimum pointing at the double slit. Then you take a piece of paper to the wall and measure the distance of the fringes with frying 5 going from the left and to the right of the center point and repeat for the other set.

2. ~~Record the value of L given in your assigned data pack.~~

$L_{measured} =$ _____

3. **Removed**

4. Measure and record the value of $2y_5$ for both sets of slits.



1.9cm = 1.9cm

d=0.0495cm

$0.0495 \sin\left(\arctan\left(\frac{0.755}{4200}\right)\right)$

$y_M = L\tan\theta \rightarrow 4200\tan(0.00103)$

$y_M = 0.755cm$

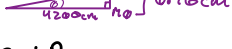
11.4.3

$d\sin\left[\arctan\left(\frac{y_M}{L}\right)\right] = M\lambda$ $\quad L = 42m \rightarrow 4200cm$

d=0.1065cm

$0.1065 \sin\left(\arctan\left(\frac{0.755}{4200}\right)\right)$

$\arctan\left(\frac{0.76}{4200}\right) \approx 0.00103$



1. Using only the data from the lab, compute for both sets of slits.

Set A 8.89×10^{-6} = 1.91×10^{-5} Set B

2. Use the combination of eq. 11.1 and 11.2 in the lab manual to compute the wavelength of the laser for both sets of data. Show your work.

4.474×10^{-6} $\quad$ 4.636×10^{-6}

3. Use the small angle approximation to compute the wavelength a second time for the two sets of fringes (show your work).

4. Compare your answer in (5) to your answer in (2). Are you justified in using the small angle approximation here? Explain your answer.

5. Compare your measurement(s) of the laser wavelength to the known wavelength for a helium neon laser. What is the percent difference?

$$\frac{4.474 \times 10^{-5}}{6.328 \times 10^{-5}} \times 100\% = 7\%$$