PHY 124 Worksheet – Interference and Diffraction

PART I

Micrometer zero reading: _________________________________

Micrometer reading with hair: _______________________________

Hair diameter (include unit and estimate of uncertainty in measurement):

__________________________ +/- __________________________ [ ]

When the hair is positioned vertically which way does the diffraction pattern spread out?

______________________________________________________

When the hair is positioned horizontally which way does the diffraction pattern spread out?

______________________________________________________

What happens to the pattern, specifically the positions on the intensity maxima, when you move the frame closer to the wall? How are $D$ and $x$ and related?

______________________________________________________
What is the wavelength of the laser light (in meters)? ______________________ m  
Distance D between the frame and wall (include unit and error):  

______________________________  

Place Tape Here:  

<table>
<thead>
<tr>
<th>Order m</th>
<th>2x (m)</th>
<th>x (m)</th>
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Estimate of uncertainty in 2x: ______________________ m  
Estimate of uncertainty in x: ______________________ m  
Slope of graph: ______________________ +/- ______________________ m  

Hair diameter from diffraction (b): ______________________ +/- ______________________ m  

Are the two values you have measured for the hair diameter consistent?
PART II

**Single Slit Diffraction:**
Is the blue pattern wider or narrower than the red one? Why?

How do the central maximum and the minima vary with slit width \( b \)? Explain.

Why does the pattern eventually disappear when \( b \) becomes very large \( (b \gg \lambda) \)?

**Double Slit Interference:**
As you go from E2 to E5 how does the number of two slit interference maxima (or minima) inside the central diffraction maximum change?

The slit widths are the same for all slits in column E. What does this mean for the width of the central diffraction maximum?

**Many slits: going toward the diffraction grating**
Explain your observations about the change in the spread of the maxima from slide to slide in terms of the equation \( m\lambda = d \sin \theta \) using the fact that different numbers of slits are etched into the same size area on the different slides.