Department of Physics and Engineering Physics

Name Lab Partner

Date Sec Lab Partner

**EXERCISE: Exp. # 13** **Interference and Diffraction**

In this exercise, you will explore the wave nature of light. You will pass monochromatic laser light through a narrow slit and observe a diffraction pattern on a sheet of paper. The diffraction pattern is evidence of the wave nature of light. You will measure properties of the diffraction pattern to determine the wavelength of the monochromatic laser light.

APPARATUS

Diode laser, single slit apparatus, optics bench, paper and ruler.

PROCEDURE

**Laser Safety: Though our lasers are low-power (they won’t burn holes thorough you), their light is very intense and could damage your eyes. For this reason:**

**• do not look directly into a laser beam;**

**• point lasers away from others;**

**• terminate the beam (make sure it stops on a nearby wall, screen, etc.).**

PROCEDURE

Set-Up:

1. Position the laser at one extreme end of the optics bench and the Single Slit Set accessory on the bench just inside it. Position the viewing screen or sheet of paper at the other extreme end of the optics bench.

2) Measure the distance, L, from the face of the single slit apparatus to the viewing screen and record.

1. Sketch the conceptual experimental diagram. Using the path length difference concept and the small angle approximation (where sinθ ~ tanθ), derive an expression for the wavelength of the light (**λ**) in terms of slit width (**a**), distance to minima (**ym**), minima order number (**m**) and distance between slit and screen (**L**).

4) Turn on the laser and ensure that it is shining upon one of the slits of the slit

apparatus. You many need to rotate the slit apparatus.

5) Find the part of the single slit apparatus that continuously varies in slit width and adjust apparatus such that the laser shines onto this variable width slit. View the interference pattern on the screen. Rotate the apparatus slowly back and forth and observe the changes to the interference pattern taking note as to whether the slit width is increasing or decreasing. Describe the relationship of slit width to the appearance of the interference pattern.

6) Project the interference pattern of the single slits of slit width: a = 1.6 x 10-4 m, 8.0 x 10-5 m and 4.0 x 10-5 m. With a ruler measure very carefully the distance from the center of the first minimums on each side of the central maxium. This is equal to 2y. Divide this distance and record y for each slit width.

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| --- | --- | --- |
| **Slit Width** | **Distance to 1st Minima** | **Wavelength** |
| **a (m)** | **y (m)** | **λ (m)** |
|  |  |  |
|  |  |  |
|  |  |  |
| **Average (m)** | |  |

7) Find the percent difference from the specified wavelength of the laser.