Laser Applications (Make-up Lab)

Name_____ ID_____ TA_____

Partners_____

Date_____ Section_____

Please do not look into the laser directly. Set up the laser so that it is not at eye level.

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1. Measuring of diameter of a wire:

➢ Formula

$$a = \frac{n \lambda D}{y_n}$$

where a is diameter of the wire, n is the order of intensity maxima, λ is wavelength of the laser, D is the distance between the wire and screen, and y_n is distance of n-th intensity maximum from the central maximum.

$D =$ _____(feet) × 0.3048 + _____(inches) × 0.0254 $\Rightarrow$ _____(meters)

$\lambda = 6.328 \times 10^{-7}$ (m)

n	left y_n	right y_n	Ave. y_n (left+right)/2	a (diameter of the wire)
1				
2				
3				
4				
Average value of a $\Rightarrow$				

How well do your values agree with each other and with the expected value of 1.57×10^{-4} m?

2. The coherency of laser beam:

Distance (feet & inches) ➜	Distance (m)	Diameter (m)

- The coefficient of coherency = _____

➢ **Quiz** ☺ If the distance between the earth and moon is 3.9×10^8 m, what is the diameter of the laser spot?

_____ (m)   _____(miles)

Lab Procedure for Laser Applications

Please do not look into the laser directly. Set up the laser so that it is not at eye level.

1. <u>**Measuring of diameter of a wire**</u>

- **Hang the wire on a bar; and to make it stable, hang a weight at the end of wire.**

- **Illuminate the laser beam on the thin wire to get a diffraction pattern.**

- **Measure the distances from central max to several intensity maxima, left and right y_n. Also calculate the average.**
  You will use a caliper to measure them. The procedure is the same as the double-slit experiment.

- **Measure the distance between the wire and screen.**

- **Use the wavelength of the laser beam, 6.328×10^{-7}(m), and the order n for each case; then, calculate the diameter of wire with the provided formula.**

2. <u>**The coherency of laser beam**</u>

- **Go to a corridor with the laser, screen, and caliper.**

- **Fix the laser at a certain place, and illuminate it on the screen; then measure the diameter of spot.**
  The separation distance should be about 2.0 m.

- **Repeat the pervious procedure 5 times.**

- **Plot the graph, distance vs diameter; then find the slope (The coefficient of coherency) by using Excel.**
  The x-axis is the distance. The y-axis is the diameter. After obtaining the line equation, take the coefficient of the variable, x. If you are not sure how to get the slope with Excel, please refer to the manual provided by TA.

- **Calculate the laser spot diameter when you illuminate the moon.**
  1 mile = 1.61×10^3 m

<u>Lab report</u>

Feel free to discuss what you learned, what you didn't understand.