

PHYF214 PHYSICS LAB REPORT SEM1 2018-2019

Lab 2 Group 7: Laser Characteristics [LC]

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16th August, 2018

1 Experimental Tasks

1. To measure the transverse beam profile of He-Ne laser and to determine the divergence.
2. To construct a beam extender and measure the divergence of the beam having larger cross-sectional area and to study how the divergence depends on the beam size.

2 Apparatus

He-Ne Laser, photo-detector, Photo amplifier, Multimeter/Voltmeter.

3 Theory

LASER which is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation, is a source for highly coherent and culminated light source. It can be theoretically derived that the LASER intensity varies vertically and forms a Gaussian. The light emitted by a laser is confined to a rather narrow cone, but as the beam propagates outward, it slowly diverges or fans out. At the output aperture of the laser, the beam diameter is d . Its beam divergence angle θ . In traversing a distance l , the beam diverges to a circle of diameter d' . Thus the beam divergence is an angular measure of increase in beam diameter with distance. So we can calculate the divergence θ as

$$\tan\theta = \frac{d - d'}{l} = \frac{w(z_1) - w(z_2)}{z_1 - z_2} \quad (1)$$

The laser beam is scanned horizontally in incremental steps and intensity is recorded using a photo-detector and amplifier.

4 Observations and Analysis

4.1 Part 1: Without beam expander

Least count of micrometer= 0.01 mm.

Photodetector	position(in mm)	Intensity (in V)
0	0.06	
0.1	0.07	
0.2	0.07	
0.3	0.09	
0.4	0.11	
0.5	0.19	
0.6	0.34	
0.7	0.65	
0.8	1.5	
0.9	2.79	
1	4.61	
1.1	6.43	
1.2	7.3	
1.3	7.95	
1.4	7.05	
1.5	6.15	
1.6	4.2	
1.7	3	
1.8	1.7	
1.9	0.94	
2	0.55	
2.1	0.31	
2.2	0.22	
2.3	0.18	

4.2 Part2: With beam expander

Least count of micrometer= 0.01 mm.

5 Precautions

- Ensure that eye-level is always higher than the laser beam.
- Ensure that beam is propagating parallel to the base plane.
- Never look into the laser beam directly or even reflected from an optical surface.

- Always use wooden blockers while working with laser beam.

6 Conclusions and Results