PHYF214 PHYSICS LAB REPORT SEM1 2018-2019
Lab 6 Group 7: Fresnel's Biprism [FB]

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1 Experimental Tasks

1. Observing the two-beam interference of two virtual light sources created at a bi-prism.
2. Determination of the wavelength of the laser from measuring the distance of the interference pattern.
3. Determination of the prism angle

2 Apparatus

He-Ne laser, Biprism, Prism table, Lens in frame, f = +5 mm and +200 mm, Vernier callipers, Steel tape measure.

3 Theory

Refraction of the light in the two prism halves leads to two virtual light sources which are coherent with respect to each other. The superposition of these light bundles results in interference fringes. We can measure the distance between the maxima - d,B- the distance between the two virtual light sources , g - object distance, b - image distance and L_1 distance between the plane of the light sources and the plane of observation to calculate the wavelength λ using the equations:

$$\lambda = \frac{ad}{L_1}$$
$$a = \frac{Bg}{b}$$

Then the prism anlge α can also be calculated as $\alpha = \frac{a}{2g(n-1)}$

4 Observations

During the experiment the position of various instruments were placed as described in the following table:

Table 1: Position of various instruments

Object	Position (in cm)
laser stand	3
laser output	12
Lens 1	17.5
Prism table	31.5
Lens 2	41.5
Sheet	199

The various measurements obtained during 5 trials are listed below in Table.2

	Trial 1	Trial 2	Trial 2	Trail 4	Trial 5	Mean
d (in mm)	0.9	1.2	1.3	1	1.1	1.1
L_1 (in mm)	1815	-	-	-	-	-
B (in mm)	7.6	7.9	7.8	7.6	7.6	7.7
b(in mm)	1575	1575	1575	1575	1575	1575
g(in mm)	240	-	-	-	-	-
f (of lense 2)	+200mm	-	-	-	-	-
n	1.5231	-	-	-	-	-

4.1 *Analysis:*

4.1.1 Determining the wavelength

The angle of incidence α is the angle the incident ray of light makes with the normal to the reflecting surface at the point of incidence.
With the measured quantities b= 1575 mm
d=1.1 mm
B=7.7 mm
g=240 mm
we can get the distance a between the virtual light sources $a = \frac{Bg}{b} = 1.173mm$
this intermediate result enables the wavelength λ of the He-Ne laser to be determined: as $\lambda = \frac{ad}{L_1} = 711nm$ Error can be calculated using the equation

$$\frac{\Delta\lambda}{\lambda} = \frac{\Delta B}{B} + \frac{\Delta d}{d} \tag{1}$$

This comes out to be 73.87 nm.
$\therefore \lambda = (711 \pm 74)nm$

4.1.2 Determining the prism angle

With the measured quantities:
b= 1575 mm
d=1.1 mm
B=7.7 mm
g=240 mm
a=1.173 nm
n = 1.5231
The prism angle α can be obtained as $\alpha = \frac{a}{2g(n-1)} = 0.0047rad = 0.27°$
The error in α is only due to error in B $\therefore \frac{\Delta\alpha}{\alpha} = \frac{\Delta B}{B}$ giveing us $\Delta\alpha = 0.000061$ which is negligible.

5 Precautions

- Never look into the direct or reflected laser beam.
- The experiment should be performed in a dark room.
- No observer must feel dazzled.

6 Conclusions and Results

On following the procedure interference pattern were observed on the screen, which were frmed due to superposition of two virtual sources formed by the prism.
The calculations and measurements show that the wavelength $\lambda == (711 \pm 74)nm$ and the prism angle $\alpha = 0.0047rad = 0.27°$