EXPERIMENT.5

LIGHT THROUGH A PARALLEL SIDED BLOCK

Goal: Observing of refraction of light in parallel sided block and measuring amount of shift.

Theory:

If a parallel sided block which has n_2 refraction index in an ambient that has n_1 refraction index, incident ray that has i_1 angle between normal, refracts two times as when it enters and exits from matter.

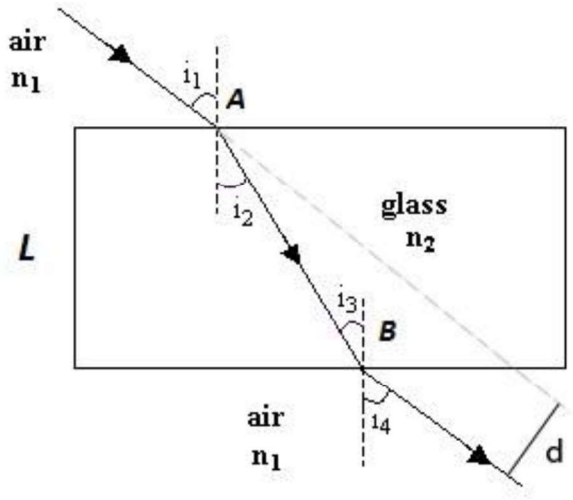

Figure 5.1

Snell law for incoming and outgoing rays:

For incoming: $n_1 \sin i_1 = n_2 \sin i_2$

For outgoing: $n_2 \sin i_3 - n_1 \sin i_4$

Using these two equations above, we can easily find that $\sin i_1 - \sin i_4$ and so $i_1 - i_4$. This equation shows that incoming and outgoing rays are parallel to each other. If we want to find amount of parallel shift(d) using trigonometric equations;

$$\cos i_2 = \frac{L}{AB}, \qquad \text{and} \qquad \sin(i_1 - i_2) = \frac{d}{AB}.$$

$d = AB\sin(i_1 - i_2) = \dfrac{L}{\cos i_2}\sin(i_1 - i_2)$ and finally the amount of parallel shift is:

$$d = L\frac{\sin(i_1 - r_1)}{\cos r_1} \qquad (1)$$

Experimental Setup:

Apparatus:

1.) Light source

2.) Parallel sided glass block

3.) Millimetric paper

4.) Goniometer

EXPERIMENTAL SETUP AND MEASUREMENTS:

Measurements:

1.) Draw three figures that illustrate shape of parallel sided glass block on millimetric paper.

2.) Set incoming angles as 30,50 and 70.

3.) Draw way of outgoing ray.

4.) Measure refraction angles using goniometer and check that your values obtain snell law.

5.) Calculate amount of parallel shift (d) using formula (1).

$L_1 = ...cm$

N	i_1	i_2	i_3	i_4	$d_{\exp}$ (cm)	d_{theo} (cm)
1	30 °					
2	50 °					
3	70 °					

$L_2 = ...cm$

N	i_1	i_2	i_3	i_4	$d_{\exp}$ (cm)	d_{theo} (cm)
4	30 °					
5	50 °					
6	70 °					

$L_3 = ...cm$

N	i_1	i_2	i_3	i_4	$d_{\exp}$ (cm)	d_{theo} (cm)
7	30 °					
8	50 °					
9	70 °					

Error Calculation:

1.) Compare theorical and experimental value of parallel shift and calculate percentage error.

2.) Find maximum absolute error of any of your measurement.

3.) Write probable error sources.

Conclusions and comments:

Write your conclusions and comments about the experiment.

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