جامعة بيرزيت

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Phys111 Report

Experiment #6: Index of Refraction

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Section:	28		
Date:	21/11/2024		

(1) Abstract:

- Aim of the experiment:

To determine the refractive index of glass when light air to it.

- The main result is:
  - The index of refraction of the block is $\mu = 1,58 \pm 0,03$

(2) Data:

	i		$\bar{i}$	$\sin\bar{i} = y$	r		$\bar{r}$	$\sin\bar{r} = x$
	i_1	i_2	$\left(\frac{i_1+i_2}{2}\right)$		r_1	r_2	$\left(\frac{r_1+r_2}{2}\right)$	
1	10°	11°	10,5°	0,18°	6°	6°	6°	0,10°
2	20°	21°	20,5°	0,35°	12°	12°	12°	0,20°
3	30°	31°	30,5°	0,50°	18°	18°	18°	0,31°
4	40°	42°	41°	0,66°	24°	24°	24°	0,40°
5	50°	51°	50,5°	0,77°	28°	29°	28,5°	0,48°
6	60°	61°	60°	0,86°	32°	32°	32°	0,53°

(3)Calculations:

Let $x = sin(\bar{r})$, $y = sin(\bar{i})$

x_i	y_i	$x_i y_i$	x_i^2
$0,10^\circ$	$0,18^\circ$	0,018	0,01
$0,20^\circ$	$0,35^\circ$	0,070	0,04
$0,31^\circ$	$0,50^\circ$	0,155	0,096
$0,40^\circ$	$0,66^\circ$	0,264	0,16
$0,48^\circ$	$0,77^\circ$	0,370	0,23
$0,53^\circ$	$0,86^\circ$	0,456	0,28
$\sum x_i = 2,020$	$\sum y_i = 3,320$	$\sum x_i y_i = 1,333$	$\sum x_i^2 = 0,816$

$$D = 6\left(\sum_{i=1}^{6} x_i^2\right) - \left(\sum_{i=1}^{6} x_i\right)^2 = 6*(0,816) - (2,020)^2 = 0,8156$$

$$\mu = \frac{6(\sum_{i=1}^{6} x_i y_i) - (\sum_{i=1}^{6} x_i)(\sum_{i=1}^{6} y_i)}{D} = \frac{6*(1,333) - (2,020)(3,320)}{0,8156} \approx 1,58$$

$$b = \frac{(\sum_{i=1}^{6} x_i^2)(\sum_{i=1}^{6} y_i) - (\sum_{i=1}^{6} x_i)(\sum_{i=1}^{6} x_i y_i)}{D} = \frac{(0,816)*(3,320) - (2,020)*(1,333)}{0,8156} = 0,02$$

$(y_i - mx_i - b)$	$(y_i - mx_i - b)^2$
$0,18 - 0,158 - 0,02 = 2\times10^{-3}$	$0,4\times10^{-6}$
$0,35 - 0,316 - 0,02 = 0,014$	$1,96\times10^{-4}$
$0,50 - 0,4898 - 0,02 = -9,8\times10^{-3}$	$9,604\times10^{-5}$
$0,66 - 0,632 - 0,02 = 8\times10^{-3}$	64×10^{-5}
$0,77 - 0,7584 - 0,02 = -8,4\times10^{-3}$	$7,056\times10^{-5}$
$0,86 - 0,8374 - 0,02 = 2,6\times10^{-3}$	$6,76\times10^{-6}$
	$\sum(y_i - mx_i - b)^2 = 4,37\times10^{-4}$

$$\sigma_y^2 = \frac{1}{4}\sum_{i=1}^{N}(y - mx_i - b)^2 = 1,09\times10^{-4}$$

$$\Delta\mu = \Delta m = \sqrt{\frac{6\sigma_y^2}{D}} = \sqrt{\frac{6\times(1,09\times10^{-4})}{0,8156}} = 0,03$$