Laboratory research №4.7.3 on «Polarization»

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Our aims in this work

- the observation of polarization phenomenon;
- studing the methods of getting a polarized light;
- looking at the aspects of polarization and some magic.

The experiment setup

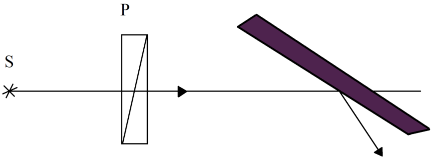

Figure 1: We put a polaroid P and a mirror (violet one) on the way of light.

Now we can make a rough estimation of polarization direction. And by adding the second polaroid we can also etimate it's polarization direction.

The experiment photos

Figure 2: With the mirror.

Figure 3: The second polaroid.

Theory behind the phenomenon

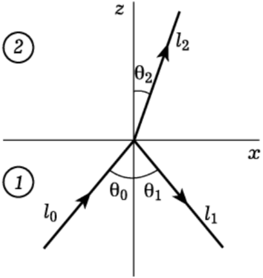

Figure 4: 0 stands for a in-going wave, 1 stands for a transmitted wave, 2 stand for a reflected wave.

The angular encounter of the light with a plane is described as

$$R_\perp = \frac{sin^2(\theta_2 - \theta_0)}{\sin^2(\theta_2 + \theta_0)}, \qquad R_\parallel = \frac{\mathrm{tg}^2(\theta_2 - \theta_0)}{\mathrm{tg}^2(\theta_2 + \theta_0)}. \tag{1}$$

The main formula

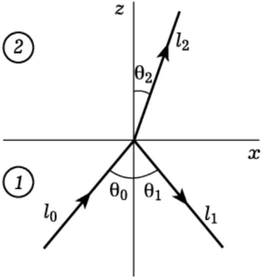

Figure 5: 0 stands for a in-going wave, 1 stands for a transmitted wave, 2 stand for a reflected wave.

An incredible aspect describes the $\theta_p = \theta_0$ wich gives $\theta_0 + \theta_2 = \pi/2$. With this and Snell's law we obtain:

$$\operatorname{tg}\theta_p = \sqrt{\frac{\varepsilon_2}{\varepsilon_1}} = n. \qquad (2)$$

Where θ_p is the angle of polarization or *Brewster's angle.*

Our measurements

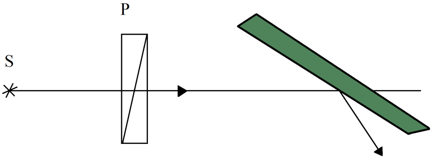

Figure 6: By rotating green ebonite plain we obtain several angles.

name	θ_p	$tg(\theta_p)$
K	240	1.73
E	237	1.54
K	237	1.54
E	238	1.60
K	236	1.48
E	239	1.66

The measurements were taken apart from each other.

Results

Figure 7: Do not repeat this with a laser beam!

The average refraction coefficient with the formula

$$\boxed{n = 1.59 \pm 0.04}$$

Is pretty close to the real $n_{\text{eb}} = 1.5 - 1.7$.

Conclusions and thoughts