

Instruction for exercise 4

Title: Testing the state of light polarization. Malus' law.

Theoretical topics

1. Spectrum of electromagnetic waves.
2. Interference, diffraction and ways of light polarization. Optically active fluids.
3. Laser light properties.

Topics for a test

1. Explain what the polarization of light is.
2. What is the impact of laser light on a tissue?

The purpose of the exercise: Study the phenomenon of polarization of light, characteristics of laser radiation, checking the law of Malus, learning safe working conditions with laser beam.

Safety remarks:

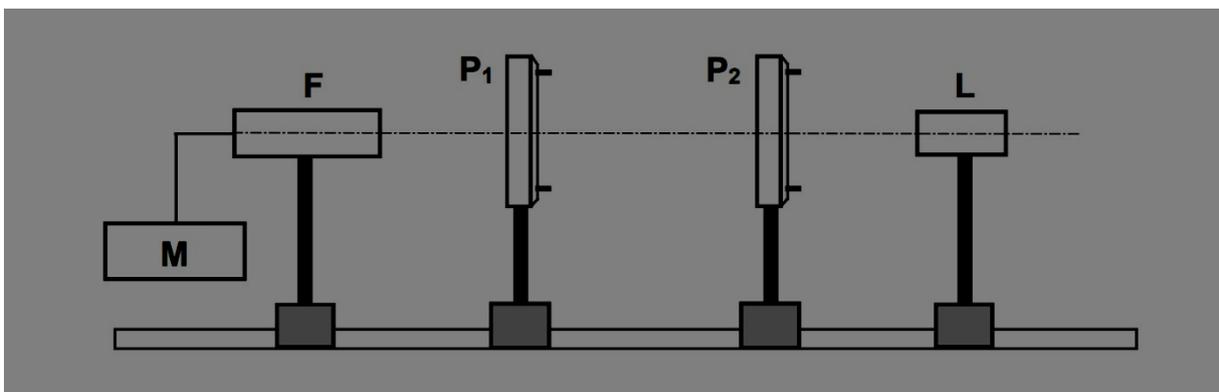
Note that working with laser light can be dangerous to your eyesight. Avoid direct or reflected laser beam effects on the eyes

Instruments:

Optical bench, polarizers, laser - light source.

Technical Introduction:

1. Set the measurement kit according to the scheme given below:



where: P_1, P_2 - polaroids (polarizer and analyzer), F- photometer, M- multimeter, L – laser head

2. Measure the transmittance (transmission) of the polarizer and analyzer depending on the angle of the polarization plane, using a laser such as He-Ne
3. Set the direction of the polarizer and analyzer transmission so that the value of the meter M is the maximum
4. Perform measurement of current value dependence on the angle of rotation of the analyzer relative to the polarizer.

Rotate the analyzer holder and record results every 10° (in the range of 0° – 90°). Perform 3 series of measurements for each position of the analyzer.

Measurements and reporting:

1. Make a plot of the function $I_{avg}=f(\cos^2\alpha)$.
2. Read from the plot $I_{avg}=f(\cos^2\alpha)$ the values I_0° and I_{90° and substitute for formula:

$$I_\alpha = I_{90^\circ} + (I_0^\circ - I_{90^\circ})\cos^2\alpha$$

From the above formula, for the values I_0° and I_{90° calculate theoretical values I_α and put them into $I_{avg}=f(\cos^2\alpha)$ graph as reference curve.

3. Make a plot of the function $f(\alpha) = \frac{I-I_{min.}}{I_{max}-I_{min.}}$.

Place the results in the table presented below:

Analyzer angle of torsion α	I_1	I_2	I_3	$I_{avg.}$

0°				
10°				
10°				
20°				
30°				
40°				
50°				
60°				
70°				
80°				
90°				