Wroclaw University of Science and Technology

GENERAL PHYSICS
LABORATORY REPORT

Theme of class: EXTERNAL EXAMINATION OF THE PHOTOELECTRIC

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1 Introduction

1.1 Theory

The measurement of the speed of light is a fundamental experiment in the field of physics, as the speed of light is one of the fundamental constants of the universe. The speed of light in a vacuum, denoted by the symbol c, is approximately 299,792,458 meters per second, and is a fundamental constant that underpins many theories in physics. The speed of light plays a crucial role in the fields of astronomy, cosmology, and quantum mechanics, among others.

There are many methods to measure the speed of light, and one of the earliest and most famous was performed by the Danish astronomer Ole Rmer in the late 17th century. Rmer observed the moons of Jupiter and noted that their observed periods varied as the distance between Jupiter and Earth changed due to the Earth's orbit around the Sun. By measuring the time delay between different positions of the Earth, Rmer was able to estimate the speed of light.

1.2 Equipment

The equipment used in this experiment included:

- Device for measuring the speed of light with a phase shifter and transmitting and receiving diodes
- Oscilloscope
- Mirror system
- Converging lens
- Ruler with a scale
- Liquid cells.

2 Experiment

2.1 Air

The purpose of this exercise is to determine the speed of light signal propagation in both liquids and air and calculate the refractive index for the materials being tested. The primary objective is to improve our comprehension of light's behavior in various substances by determining the speed at which light signals propagate through them. Moreover, the experiment aims to compute the refractive index of these substances, a vital attribute in the optics field. Through these objectives, we can acquire valuable insights into the interplay between light and different materials, leading to advancements in optics and related scientific disciplines.

x_0	u(x_0)	x_1	$\bar{x_1}$	u_a
[cm3̂]	[cm]	[cm]	[cm]	[cm]
1	1	133	135.44	3.43
		136.5		
		134.5		
		134		
		136		
		133.5		
		136.5		
		139.5		

ub(x_0)	u(x_1)	f	c_p	
[cm]	[cm]	[MHz]	[m/s]	
0.19	3.43	50.1	271416750	

Table 1: table

Calculations

$$c_p = 4 \cdot f \cdot \bar{x_1} = 4 \cdot 50.1 \cdot 10^6 \cdot 135.4375 \cdot 100 = 271,416,750[m/s] \tag{1}$$

$$u_b(x_0) = \sqrt{\frac{(\Delta_p x)^2}{3}} = \sqrt{\frac{(1)^2}{3}} = 0.19[cm] \tag{2}$$

2.2 Liquid

In this exercise are going to take measurements of the current-voltage characteristics. Measure the current-voltage characteristics of the photocell.

$\bar{x_1}$	u(x_1)	x_2	$\bar{x_2}$	$u_b(\bar{x_2})$
[m]	[cm]	[cm]	[cm]	[cm]
135.44	3.43	114.5	114.5	0.19
$u(x_2)$	Δx	c_p	c_c	n_c
cm	cm	m/s	m/s	
0.19	20.94	271416750	191,306,960.4	1.57

Table 2: table

Calculations

$$c_c = \frac{c_p}{1 + 2 \cdot \frac{\Delta x}{l}} = \frac{271,416,750}{1 + 2 \cdot \frac{20.9375}{100}} = 191,306,960.4[m/s] \tag{3}$$

$$n_c = \frac{c}{c_n} = \frac{271416750}{191,306,960.4} = 1.57 \tag{4}$$

$$\Delta x = \bar{x}_1 = \bar{x}_2 = 135.44 - 114.5 = 20.94[cm] \tag{5}$$

3 Conclusion

In conclusion, the folding method has demonstrated its effectiveness and convenience in measuring the speed of light in liquids and air. This experiment has not only shed light on how light behaves in different materials, but it has also enabled the determination of their refractive indices, which is a crucial property in optics research. By using the folding methods simplicity and geometric optics principles, we have successfully calculated the speed of light propagation in various liquids and air. This knowledge provides a deeper understanding of lights interaction with different substances and can potentially lead to advances in optics and related scientific fields. In conclusion, the folding method is an excellent tool for both researchers and students, facilitating continued exploration of the intriguing world of light and its numerous properties.