Wroclaw University of Science and Technology

GENERAL PHYSICS
LABORATORY REPORT

Theme of class: MEASURING THE SPEED OF LIGHT BY THE FOLDING METHOD VIBRATION

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Contents

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.

Speed of light plays a significant role in helping us understand the universe and its workings. The velocity of light in various materials, such as liquids and air, is essential for analyzing how it moves through these substances. Such analysis can aid in understanding the refractive index, a crucial aspect of optics research. This paper introduces an innovative and straightforward technique, known as the folding method, to measure the speed of light accurately. We use this method to determine the speed of light in liquids and air, which, in turn, helps us calculate their respective refractive indices. By presenting this information, we aim to demonstrate the effectiveness and simplicity of the folding method in enhancing our knowledge of how light behaves in different substances, which can have implications for optical and other scientific research areas.

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
[cm$\hat{3}$]	[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.