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# Optics Lab 7

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## 1 OVERVIEW OF EXPERIMENT

This lab was focused on polarization of light. It was set up in the usual U type geometry for most optics experiments and the light source was aligned to the rail as usual. There was one polarizer set up as a polarizer of the incoming light and the other was set up as an analyzer, the set up of this is shown below.

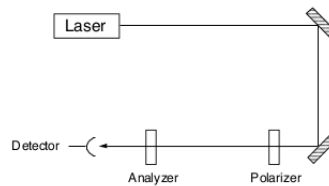


Figure 1.1: Set Up

## 2 LAW OF MALUS

The Law of Malus is used to describe the intensity of light coming from a linear polarizer as a function of angle  $\theta$  between the polarizer transmission axis and the plane of polarization can be described by,

$$I(\theta) = I_0 \cos^2(\theta) \quad (2.1)$$

With the aligned optical rail we set up the outcoming light from the analyzer to start at the first minimum (finding this experimentally). The first minimum was observed at  $\theta = 120^\circ$ .

From the first minimum we vary the angle in steps of 10 degrees until the next minimum is observed. The experimental vs theoretical plots of this shown below,

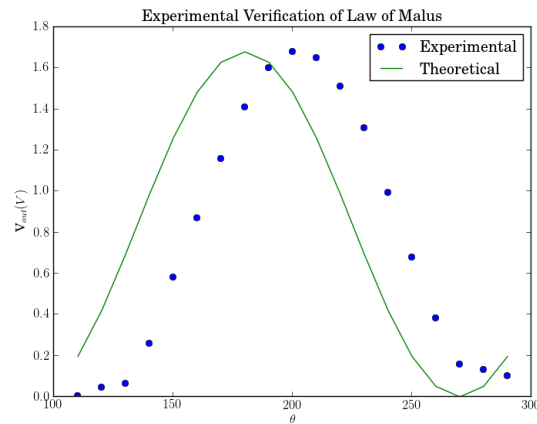


Figure 2.1: Experimental vs Theoretical for Malus's Law

from what is observed above one can see that there is a phase shift between the experimental and theoretical plots. This primarily comes from measurement error from the experiment. This could be reduced by taking smaller step sizes in the polarizer and less interference from the incoherent light source (the room light) and better alignment from the optical equipment.

### 3 LINEARLY POLARIZED LIGHT AND INTERFERENCE FROM MICROSCOPE SLIDE

In this section we found the brewster angle of the glass slide and switched the incoming light to s-polarization from the lab instructions. However the second part does not have enough data because the interference pattern could not be observed.

## 4 ABSORPTION OF MATERIALS

In this part of the lab we used a spectrometer to measure the transmission of light through colored slides and also measured the transmission and reflection of a thin film.

### 4.1 COLORED SLIDE

We calibrated the spectrometer so that it was set to zero the natural light of the room. We passed light through the various slides and observed the plots of the transmission shown below.

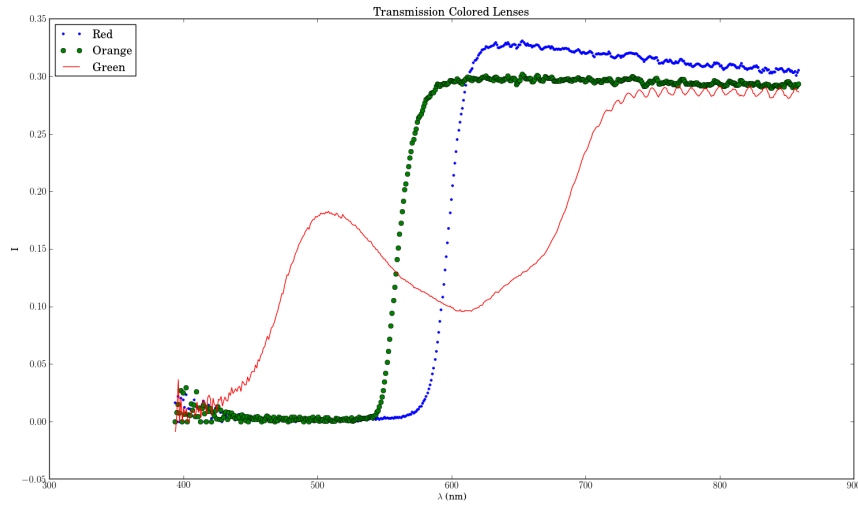


Figure 4.1: Transmission of light through colored slides

From figure 4.1 we can see that the transmission function corresponds to the wavelength of the particular color. So the transmission only allows the wavelength of the color or higher through or stated another way, the light that gets transmitted through the material will show only those wavelengths of light that are not absorbed.

## 4.2 THIN FILMS

In this part of the experiment we wanted to find the thickness of a thin film on the properties of the reflection and transmission. We can plot the the absorption of the thin film using Beer-Lambert Equation given below,

$$\alpha(\lambda) = \frac{-\ln(\frac{T}{1-R})}{d} \quad (4.1)$$

from the lab we know that the thin film has a thickness of 243 nm, so  $d = 243nm$ . so the plot of the absorption coefficient is shown below.

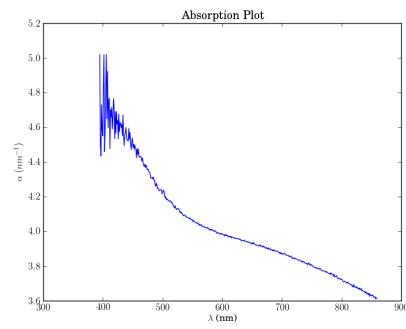


Figure 4.2: Absorption coefficient in thin film

The light is absorbed mostly at lower wavelengths and has a high peak at the somewhere around 420 nm.

## 5 CONCLUSION

Although I did not get to the second the interference in the microscope slide. The interference pattern can be explained by 9.37 in Hecht on Dielectric films and the derivation follows from the book, thus it wasn't included.