

Physical Experiment 4

Polarized Light

**郑长刚**

(2016200302027)

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**Abstract** (About 100 words, 10 points)

For finishing this experiment in time, I cooperated with a partner, Yue, which can help us to finish our task effective and efficiently.

This experiment introduces the phenomenon of polarization of light by using the polarizer and analyzer. It also shows the method of detecting elliptical and circular polarization.

As we went through the process of this experiment, we found a lot of phenomenon, for instance, direction and intensity of those polarised light, which was depending on the angle between oscillation direction of the incident light and the transmission axis of polarisers.

The photocurrent and angle θ are read and recorded from microammeter, these data would be used to prove the law of Malus. Moreover, by rotating the analyzer, the quarter-wave plate and the half-wave plate, and record the times of extinction appears, the elliptical and circular polarization are produced and the function of the quarter -wave plate and the half-wave plate is found.

By doing this set of experiments, I have known there are 4 types of light. I also grasp the theory of the quarter -wave plate and the half-wave plate. I also know something more about the polarize phenomena and the substance of the light.

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**Calculations and Results** (Calculations, data tables and figures; Use about 100 words to describe your results, 20 points)

1. **Draw a graph of the micro-ammeter reading depending on the angle**   **by using entries in Data Table 3.7-1.**

The data is on the Lab handbook and the photocopy of it is on the appendix

1. **Draw a graph of the micro-ammeter reading depending on**  **by using the entries in Data Table3.7-1.**

1. **Summarise the function of quarter-wave plate based on the entries in Data Table3.7-2.**

Change the phase difference between two output light is .

Because the quarter-wave plate is used to produce elliptically and circularly polarized light from linearly polarized light. It change elliptical polarized light to linearly polarized light.

1. **Summarise the function of half-wave plate based on the entries in Data Table 3.7-2.**

Change the phase difference between two output light is . The function of half-wave plate is used to change (shift) the polarization the polarization direction of linearly polarized light.

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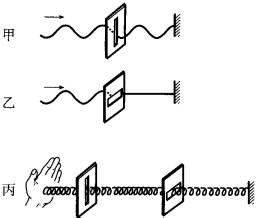
**Answers to Questions** (10 points)

1. **Explain how polarisation phenomenon indicate that light is a transverse wave.**

As we know, there are two kinds of waves. The fist is longitude wave which vibrate parallel to the propagation direction. The second is transverse wave which vibrate perpendicular to the propagation direction.

For transverse wave, the vibration direction is perpendicular to the traveling direction, however, for longitudinal wave, these two directions have no difference. For the polarizer, the amount of the light it can pass through depends on the angle between the direction of vibration direction and the axis of the polarizer.

So, according to the feature of these waves, only the beam with transverse wave can be various, which can be observed in the experiment. The angle formed with longitudinal wave will not be changed.



1. **In the step 3 of 3.7.4.3, how many times of extinction can you observe when rotating the half-wave plate from 0 to 360 degree? State the reasons.**

We can observe this phenomenon 4 times.

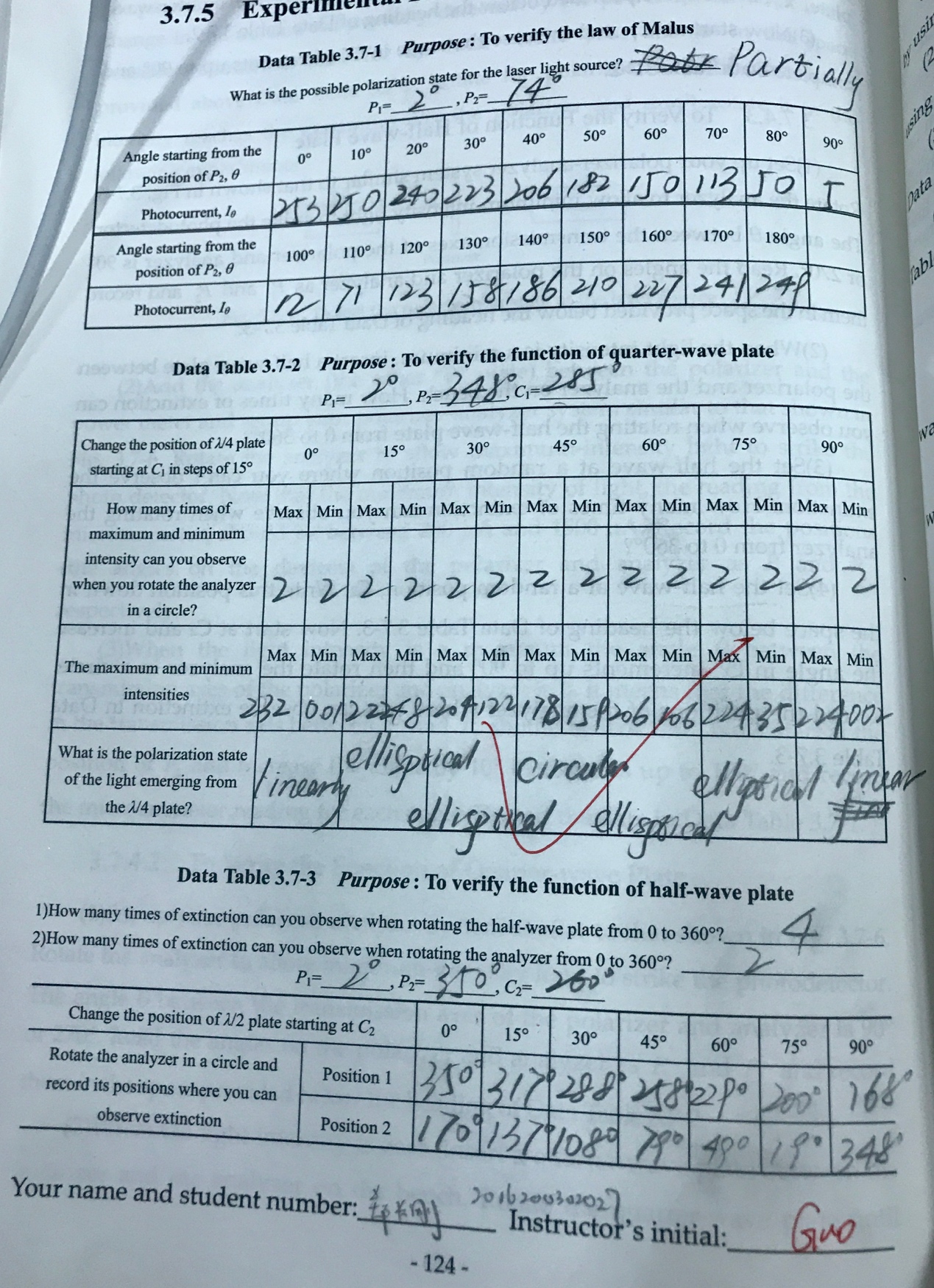
The half of that occurs when the transmission axis of the half-wave plate is perpendicular to the direction of the oscillation light when it passing the polariser. Another two times happened when the oscillation direction of the polarised light passing the half-wave plate is orthogonal to the transmission axis of the analyser.

1. **How can you distinguish between an unpolarised light and a circularly polarised light?**

We have the method as follows. Let the light beam pass through a quarter-wave plate. And then, let the beam pass through a polarizer. After that, we rotate the polariser. If the light intensity doesn’t change, Unpolarised light is still unpolarised light after it passing through a quarter-wave plate. If the light intensity changes and occurs two times of extinction, It is circularly polarised light, as the it go through the quarter-wave plate, the circularly polarized light has already been changed to linearly polarized light.

Appendix

**(Scanned data sheets)**

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