

Birefringence

Task and equipment

Information for teachers

Additional Information

Because the photo-electric current of the solar cell depends very much on the intensity of the incident light, care must be taken that the distance between the lamp and the solar cell is not altered during the course of the experiment. Furthermore, the measurement is more precise the less stray light is able to fall onto the solar cell.

Birefringence

Task and equipment

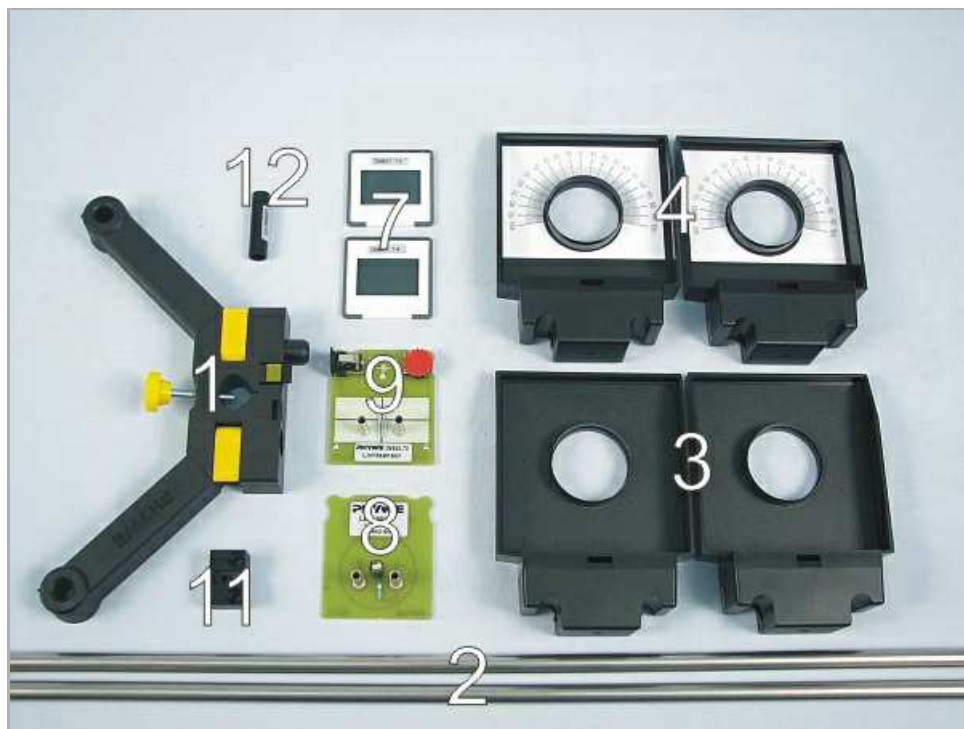
Task

How can light be 'twisted'?

In the experiment on polarisation you have already learned that light is an electromagnetic wave which can be restricted in the direction of its vibration - can be polarised. To do this two linear polarisation filters were used. In this experiment you will learn how light is polarised by birefringence.



Equipment



Student's Sheet

Printed: 18.04.2017 10:32:29 | P1419701

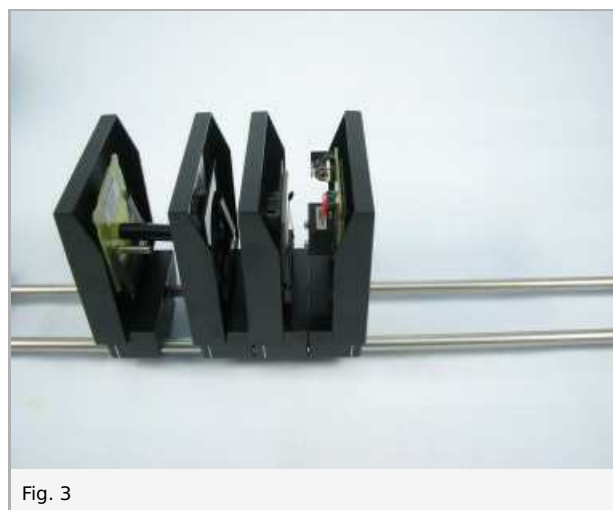
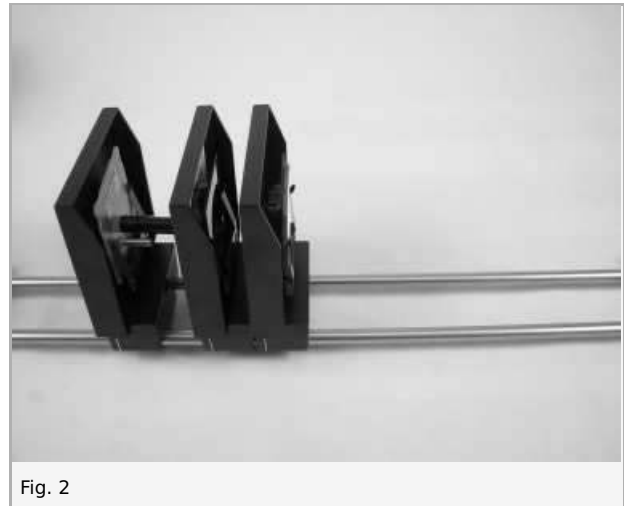


Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	2
3	Slide mount without angle scale	09851-02	2
4	Mount with scale on slide mount	09823-00	2
5	Diaphragm holder, attachable	11604-09	4
6	Lambda/4 film, in slide frame, glassless	09851-13	1
7	Polarisation filter, in slide frame, glassless	09851-14	2
8	LED - white, with series resistor and 4 mm plugs	09852-60	1
9	Light sensor with amplifier, adjustable	09852-70	1
10	Power supply, 5 V DC	09852-99	1
11	Stray light tube	09852-71	1
12	Stray light tube for LED, Di = 8 mm, l = 40 mm	09852-01	1
Additional material			
13	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
	Connecting cord, 32 A, 750 mm, red	07362-01	2
	Connecting cord, 32 A, 750 mm, blue	07362-04	2
	Adhesive tape		

Set-up and procedure

Set-up

- Fit the components onto the support rod in the order shown in figure 1. The first polarisation filter is stuck to the mount (2) by means of adhesive tape so that it cannot later be rotated unintentionally.
- Push the components close together so that the tube makes contact with the first polarisation filter and the feet of the subsequent mounts touch.



- The LED is connected to the power supply and the photodiode is connected to the multimeter - ensure that the polarity is correct!

Student's Sheet

Printed: 18.04.2017 10:32:29 | P1419701



Fig. 4



Fig. 5



Fig. 6



Fig. 7

- Connect the photodiode to the power supply.



Fig. 8



Fig. 9

Procedure

- With the polarisation filters in parallel, the power supply is set in such a way that the photodiode is within the sensitive range. (When the adjustment knob on the photodiode is rotated in the clockwise direction to the stop a maximum voltage of approx. 3.9 V will be measured.) The quarter-wave film is not yet inserted.



Fig. 10

- The mount of the second polarisation filter is taken from the rail and rotated in the anticlockwise direction to 100° . Then it is re-inserted and the voltage at the photodiode is measured and recorded in table 1.



Fig. 11



Fig. 12

- Then the mount is removed, the filter is adjusted to 90° and the mount is re-inserted and the voltage at the photodiode is measured and recorded.
- The last two steps are repeated until the polarisation filter in the clockwise direction has reached 100° .

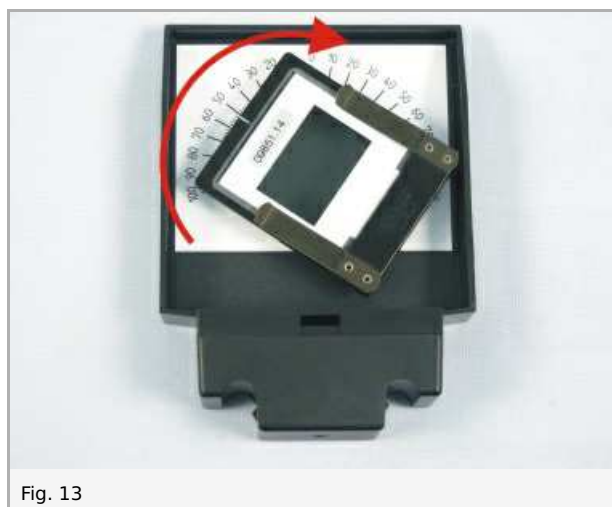


Fig. 13

- Then the quarter-wave film is inserted into its mount and set to 0° - when doing this it must be ensured that the spacing between the mounts is not altered.

Student's Sheet

Printed: 18.04.2017 10:32:29 | P1419701

- The second polarisation filter is then turned in anticlockwise direction to 100° and the measurement is carried out as described above.
- When the second polarisation filter has reached 100° in the clockwise direction, the quarter-wave film is rotated by 22.5° (or as well as it can be done with the scale) in clockwise direction.
- The measurement is repeated as above.
- The measurement is then repeated for settings of the quarter-wave film at 45° , 67.5° and 90° .



Fig. 14



Fig. 15

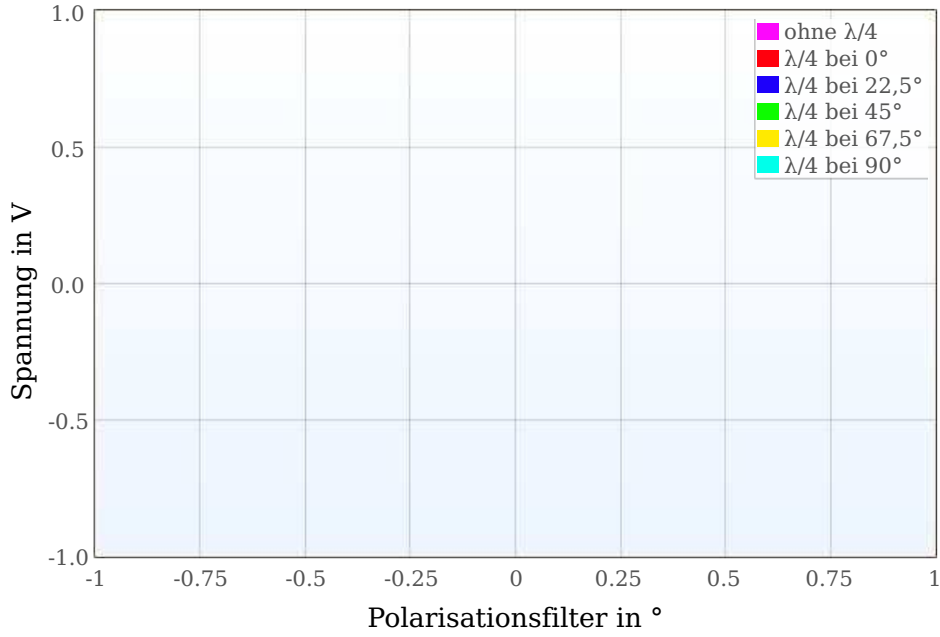
Report: Birefringence

Result - Table 1

Supplement the table 1 with the voltages of the various orientations of the quarter-wave film.

Polarizing filter in °	Photodiode voltage for various orientations of the quarter-wave film in V					
	without $\lambda/4$	$\lambda/4$ at 0°	$\lambda/4$ at 22.5°	$\lambda/4$ at 45°	$\lambda/4$ at 67.5°	$\lambda/4$ at 90°
-100	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-90	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-80	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-70	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-60	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-50	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-40	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-30	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-20	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
-10	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
10	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
20	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
30	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
40	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
50	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
60	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
70	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
80	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
90	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
100	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0

Number1



Evaluation - Question 1

Compare the measured curves to one another and identify similarities and differences.

.....

.....

.....

.....

Evaluation - Question 2

What can be said from the measured curves about the polarisation of the light? What is the effect of the quarter-wave film on this process?

.....

.....

.....

.....