Polarisation with filters

Task and equipment

Information for teachers

Additional Information

After it has been demonstrated in lessons that light undergoes interference, which can only be explained in the framework of classical physics by postulating a wave character for light, the question is now investigated of whether these are transverse or longitudinal waves.
This experiment is easy to perform and takes little time; it shows that light waves must be transverse waves.

Polarisation with filters

Task and equipment

Task

What is the effect of polarising filters?

Send a light beam through two polarising filters and investigate what happens when they are rotated against each other.

Student's Sheet

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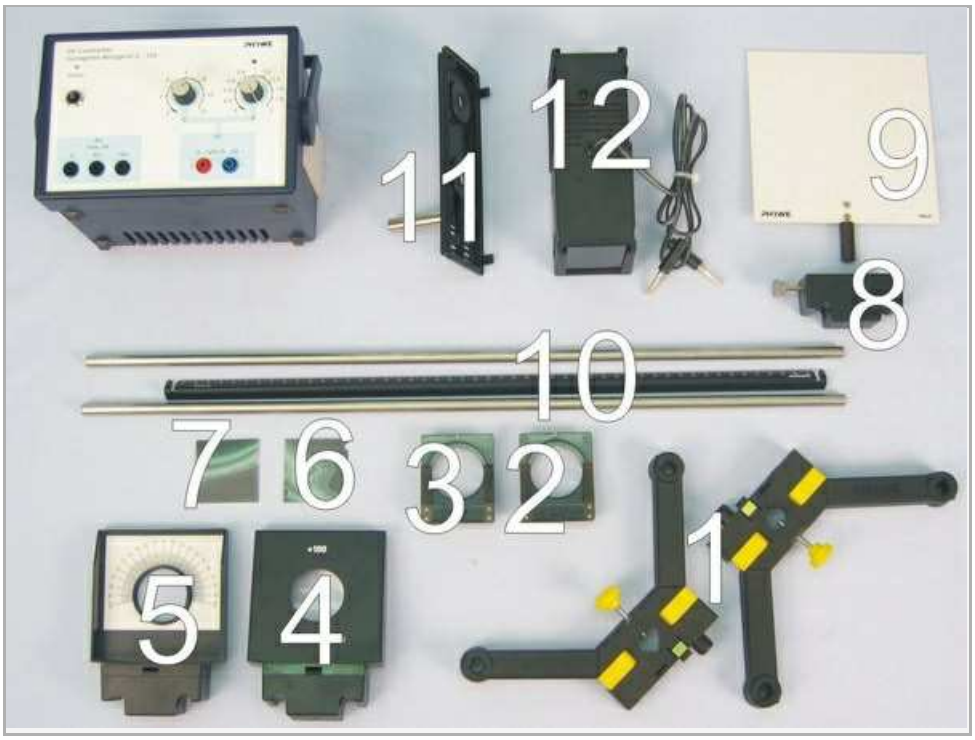
Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2/3	Diaphragm holder, attachable	11604-09	2
4	Lens on slide mount, f=+100mm	09820-02	1
5	Mount with scale on slide mount	09823-00	1
6/7	Polarising filter, 50 mm x 50mm	08613-00	2
8	Slide mount for optical bench	09822-00	1
9	Screen, white, 150x150mm	09826-00	1
10	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	2
11	Bottom with stem for light box	09802-10	1
12	Light box, halogen 12V/20 W	09801-00	1
	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Set-up and procedure

Using two support rods and the variable support base (Fig. 1) assemble the optical bench (Fig. 2).

Fig. 1

Fig. 2

Place the bottom with stem under the light box (Fig. 3, 4) and clamp it onto the left part of the support base so that the lens end points away from the optical bench (Fig. 5).

Fig. 3

Fig. 4

Fig. 5

Insert an opaque cover in front of the lens.
Place the screen onto the right end of the optical bench and the lens about 4 cm from the light (Fig. 6).

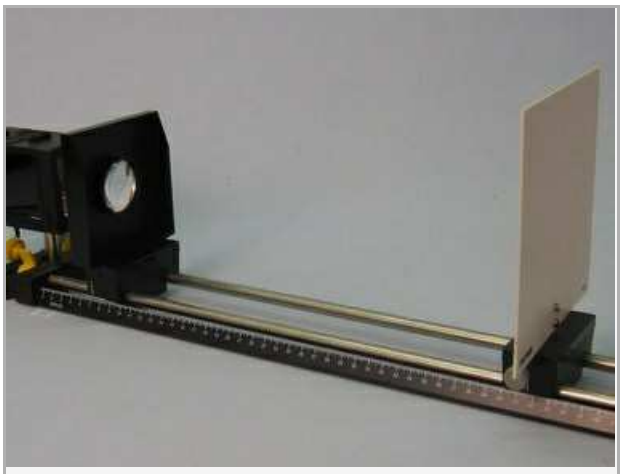

Fig. 6

Connect the light box to the power supply (12 V~) and switch it on (Fig. 7).

Fig. 7

Insert the polarising filter (the polariser) in a diaphragm holder and fix it to the frame of the lens (Fig. 8).

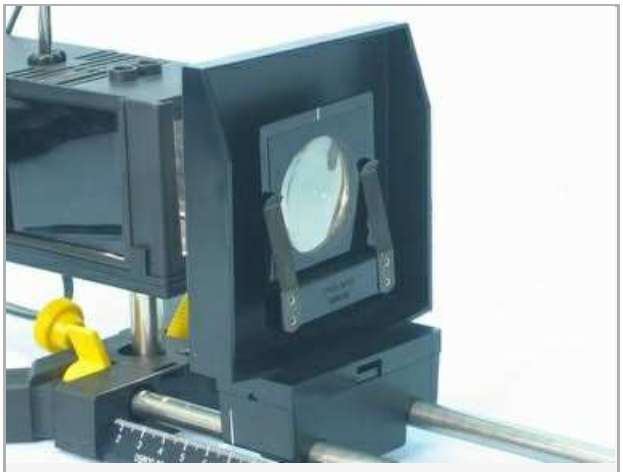

Fig. 8

Place the mount with scale about 5 cm away from the lens and fix the second diaphragm holder to it (Fig. 9).

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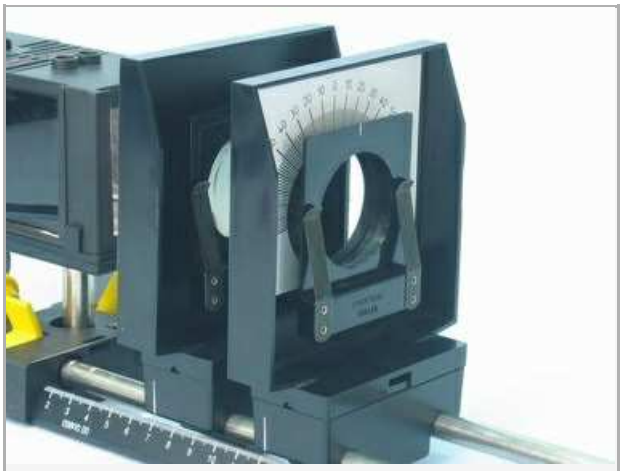

Fig. 9

Insert the second polarising filter in this diaphragm holder (Fig. 10) and make sure that the light spot is still visible on the screen. If it is not then turn the polariser by 90 degrees.

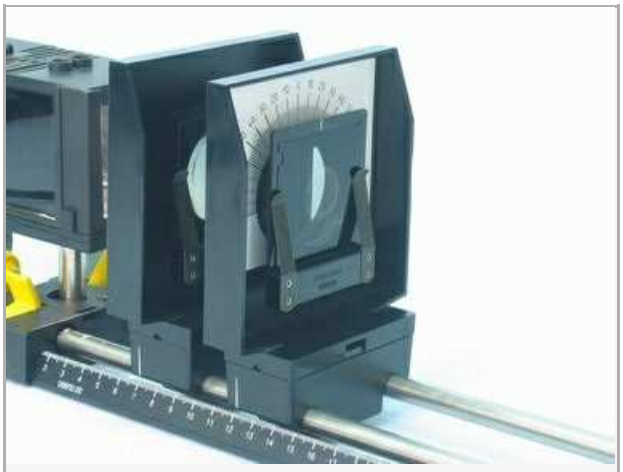

Fig. 10

Now turn the diaphragm holder which you last placed on the optical bench slowly until the angle of rotation on its scale has reached 90 degrees (Fig. 11).

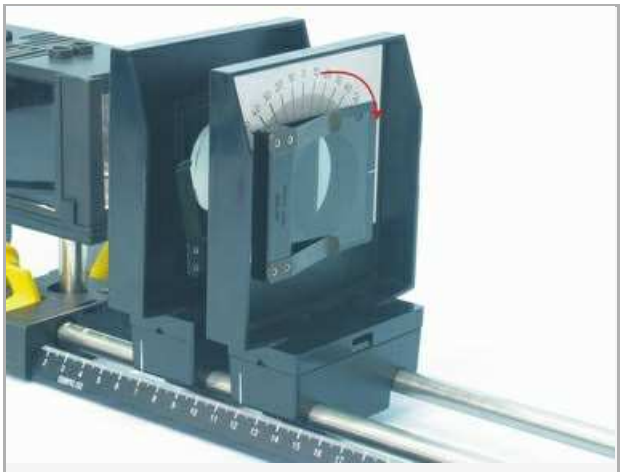

Fig. 11

Pay attention to the brightness of the light spot while doing so.
Continue turning the diaphragm holder beyond 90 degrees until it has again reached its initial position. Note your observations in table 1 in the report.

Finally turn the diaphragm holder closest to the lens while keeping the other fixed (Fig. 12). What do you notice? Record your observations in the report.

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Fig. 12

Switch off the power supply.

Report: Polarisation with filters

Result - Table 1

Enter measured values in the table.

Angle of rotation	Light spot		Equivalent to other angle of rotation	
0°	very bright	1	-	
45°	bright	1	-	
90°	dark or disappeared	1	-	
135°	bright	1	45°	1
180°	very bright	1	0°	1
270°	dark	1	90°	1
360°	very bright	1	0°	1

Result - Observation

Note down your observations during the rotating the polarising filter closest to the lens:

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Evaluation - Question 1

Summarise the result of your observations.

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Evaluation - Question 2

How can you explain these observations?

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