

Diffraction at a grating

Task and equipment

Information for teachers

Additional Information

Once it has been recognised in lessons that light can be reflected and refracted just like water waves, the question poses itself of whether light has wave character. If it does, then it must be possible to demonstrate interference phenomena as with water waves.

This experiment on diffraction at an optical grating provides a convincing proof of the interference properties of (visible) light and hence of its wave character.

Suggestions

This experiment should be performed in a room that has been sufficiently darkened. Under these conditions, second-order diffraction spectra will be clearly visible.

For additional experiments with monochrome light, filters (from the filter set additive colour mixing, cat. no. 09807-00) are recommended; these can be successively inserted into the diaphragm slot of the light box.

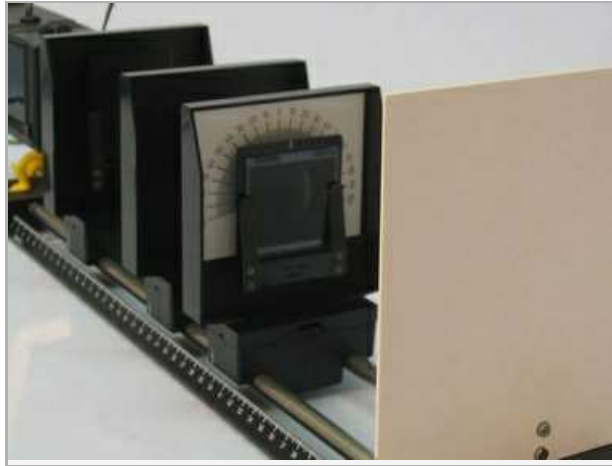
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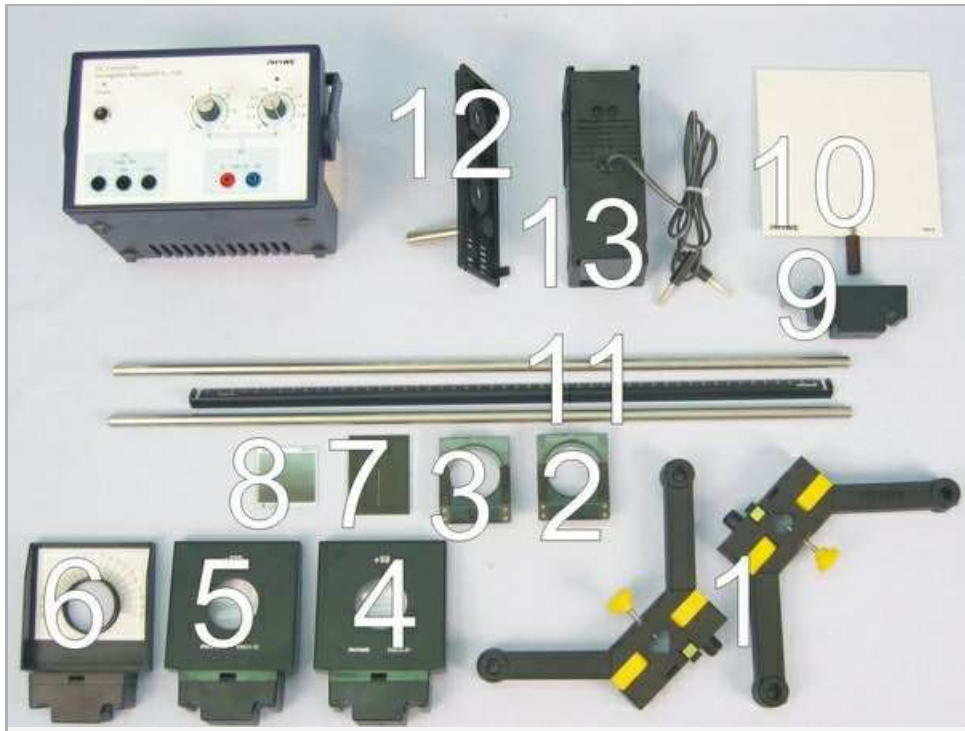
Task

What is the effect of the optical grating?

Investigate the phenomena occurring when a light beam passes through an optical grating.



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, $f=+50\text{mm}$	09820-01	1
5	Lens on slide mount, $f=+100\text{mm}$	09820-02	1
6	Mount with scale on slide mount	09823-00	1
7	Diaphragm with slit	09816-02	1
8	Grating, 80 lines/mm	09827-00	1
9	Slide mount for optical bench	09822-00	1
10	Screen, white, 150x150mm	09826-00	1
11	Support rod, stainless steel, $l = 600 \text{ mm}$, $d = 10 \text{ mm}$	02037-00	2
11	Meter scale for optical bench	09800-00	1
12	Bottom with stem for light box	09802-10	1
13	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

Set-up and procedure

Using the two support rods and the variable support base (Fig. 1) assemble the optical bench (Fig. 2); place the meter scale against the front support rod.



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

Student's Sheet

Printed: 18.04.2017 09:57:50 | P1069700

Insert an opaque cover in front of the lens on the light box.

Connect the light box to the power supply (12 V~) (Fig. 6).



Fig. 6

Place the screen at the right end of the optical bench. Place the lens with $f = +100$ mm close to the light box and adjust its position until the circular light spot on the screen has a diameter which is about the same size as that of the lens. (Fig. 7.)

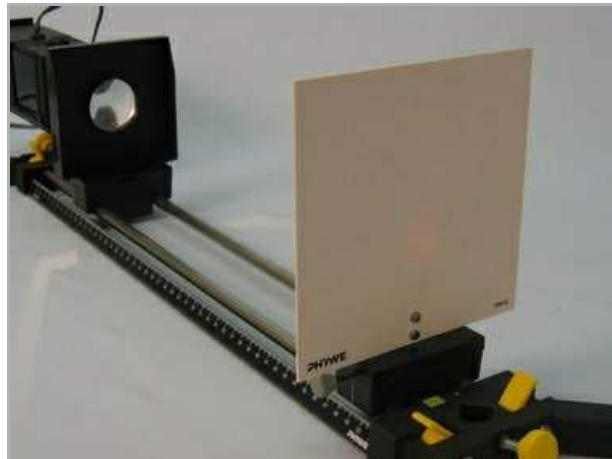


Fig. 7

Insert the diaphragm with slit into a diaphragm holder, which you should fasten to the lens (Fig. 8).



Fig. 8

Set up the lens with $f = +50$ mm and adjust its position until a focused image is produced (Fig. 9).

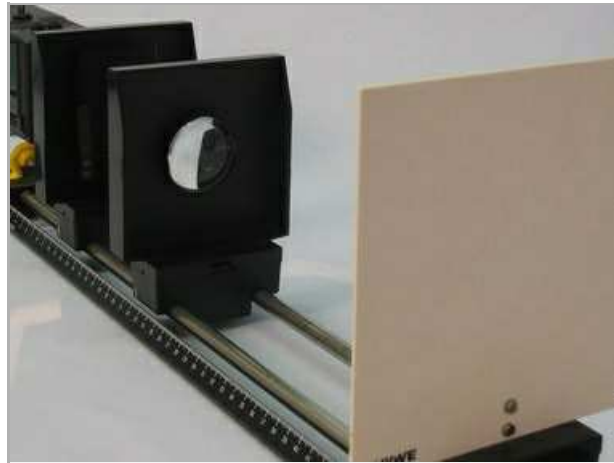


Fig. 9

Place the mount with scale to the right of the lens with $f = +50$ mm, insert the grating into the second diaphragm holder, and fasten this to the mount (Fig. 10).

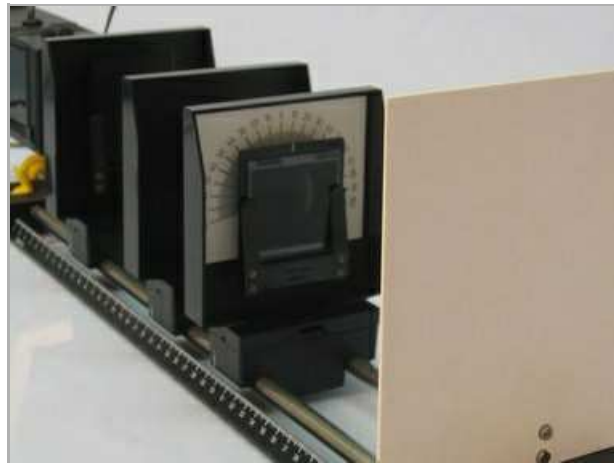


Fig. 10

Describe the image on the screen both before and after adding the grating into the light path in the report. This phenomenon is called the diffraction spectrum of light. Pay attention to the arrangement of the colours: light of which colour is diffracted the most and which the least? Record your observations in the report.

Switch off the power supply.