

Diffraction at an edge

Task and equipment

Information for teachers

Additional Information

When a narrow pencil of light strikes the edge of an obstacle, it undergoes partial diffraction. The diffracted section is superposed on the light passing the edge and, due to the coherence of the two sections of light, interference occurs in the border area between light and shadow behind the edge.

Suggestions for Set-up and Performance

The experiment can be performed in a slightly darkened room.

Diffraction at an edge

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Task

Is a sharply outlined shadow created when light is incident upon the edge of a wide obstacle?

Direct a narrow pencil of light onto the edge of an obstacle (half-plane) so that some of the light shines past the edge, and investigate the border area between light and shadow behind the obstacle.



Equipment



Position No.	Material	Order No.	Quantity
1	Light box, halogen 12V/20 W	09801-00	1
2	Bottom with stem for light box	09802-10	1
3	Support base, variable	02001-00	1
4	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	2
5	Mount with scale on slide mount	09823-00	1
6	Slide mount for optical bench	09822-00	2
7	Plate mount f.3 objects	09830-00	2
8	Slit, adjustable.up to 1 mm	11604-07	1
9	Measuring magnifier	09831-00	1
10	Diaphragm holder, attachable	11604-09	1
11	Diaphragm with single slit, bar and edge	08521-00	1
12	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1
13	Colour filter set, additive (red, blue, green)	09807-00	red filter

Set-up and procedure

Set-up

- Set up the optic bench with the two support rods and the support base and place the scale in position (Fig. 1 and Fig. 2).



Fig. 1



Fig. 2

- Assemble the light box according to Figures 3 and 4 and clamp it into the left part of the support base with the lens end pointing away from the optic bench (Fig. 5). Insert a tight fitting cover in front of the lens (Fig. 6).



Fig. 3



Fig. 4



Fig. 5



Fig. 6

- Insert the adjustable slit (light aperture) into the diaphragm holder (Fig. 7, Fig. 8) and attach this to the mount with scale (Fig. 9). Then, place the mount with scale directly next to the light box (Fig. 10).



Fig. 7



Fig. 8



Fig. 9

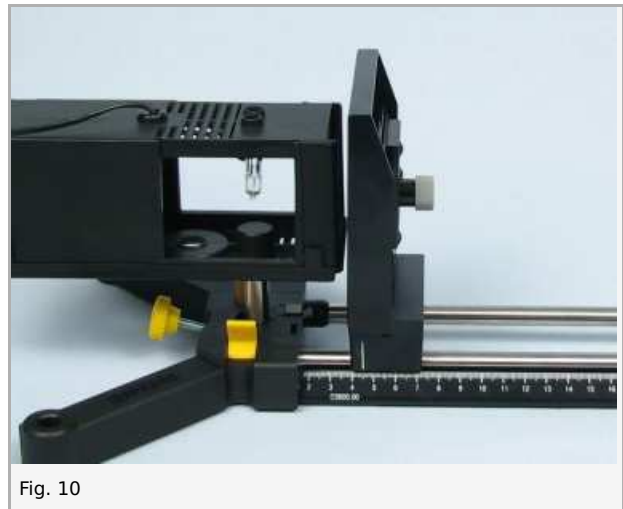


Fig. 10

- Position a slide mount with a plate mount holding the measuring magnifier at the right-hand end of the optic bench (Fig. 11).



Fig. 11

- Position the other slide mount with plate mount approx. at the centre of the optic bench (Fig. 12) and fix the diaphragm (Fig. 13) into the plate mount so that the edge is located in the middle of the light path; cover slit and bar of the diaphragm with two light-tight fitting covers (Fig. 14).

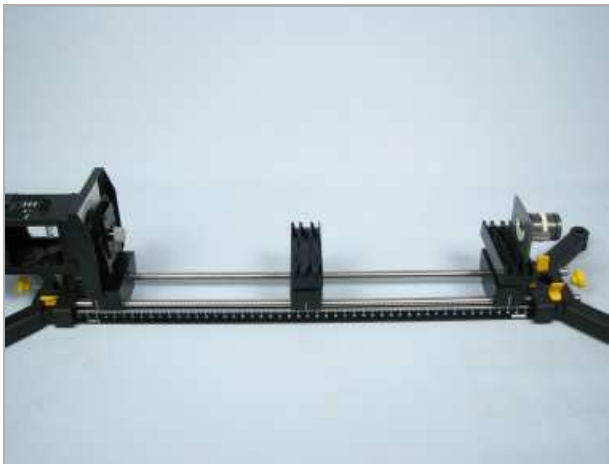


Fig. 12

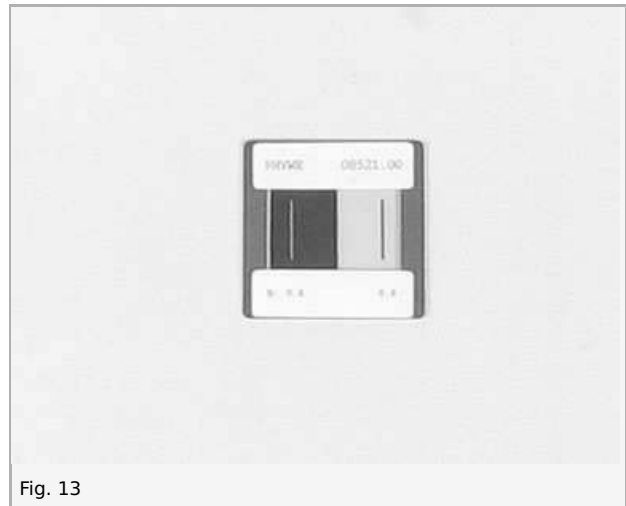


Fig. 13

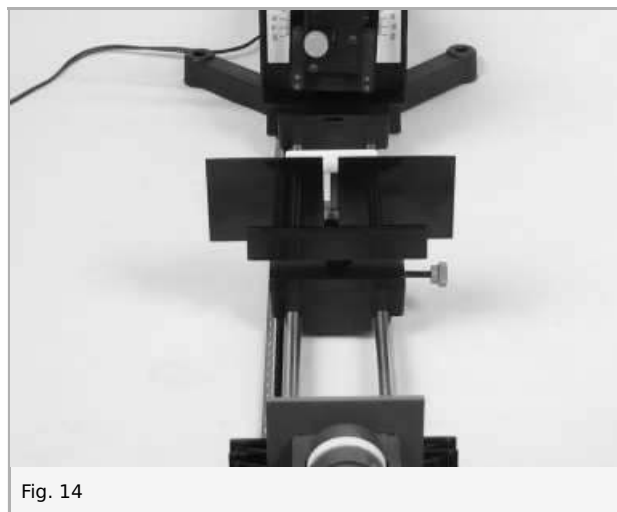


Fig. 14

- Your setup should now look like the following picture (Fig. 15):



Abb. 15

Procedure

- Connect the light box to the power supply (12 V~) (Fig. 16) and switch it on.

Student's Sheet

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Fig. 16

- Adjust the light aperture to its narrowst and move the edge until it is gazed by the light beam.
- Look through the measuring magnifier towards the edge.
- If necessary, readjust, parallel alignment of light aperture and edge, optimum width of the light aperture.
- Insert the red filter into the well of the light box (Fig. 17).



Fig. 17

- Observe the ensuing image. With the aid of Fig. 18 describe your observation and note your description in the report.

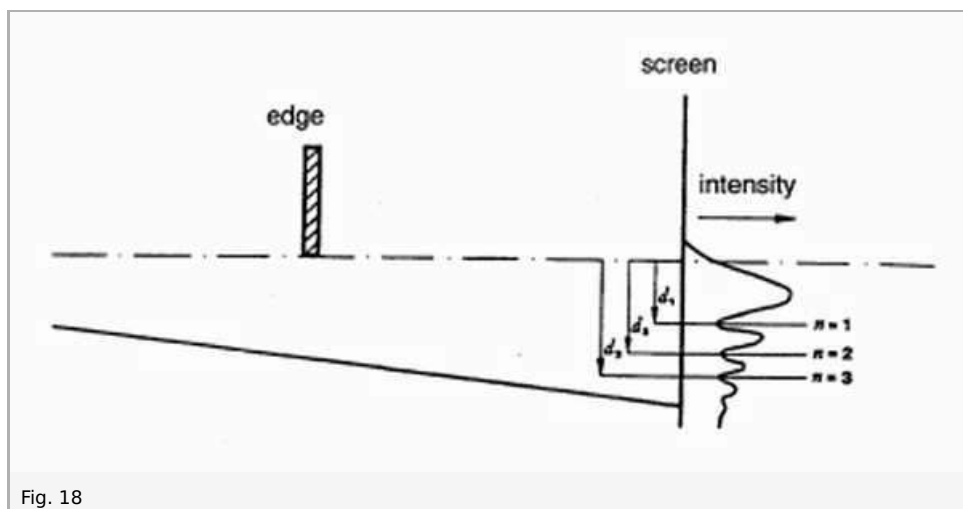


Fig. 18

- Switch off the power supply.

Report: Diffraction at an edge

Result - Observations

Note down your observations.

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Evaluation - Question 1

Explain the observed phenomenon.

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Evaluation - Question 2

Why is it impossible to observe diffraction phenomena, as they occur in this experiment, in our everyday life?

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