Rectilinear propagation of light

Physics > Light & Optics > Dispersion of light

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/5f4d932dce572a000382d72f

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Teacher information

Application

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Light beam at sunset

Light always propagates from a light source (transmitter). It can be detected by a receiver. On the way between them, it passes through optical media that can influence its propagation.

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Other teacher information (1/3)

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Prior knowledge

Knowledge of the straightness of light propagation is assumed. Students may have difficulty in sighting accurately and applying their knowledge to justify the experimental result. The experiment is therefore more demanding in terms of the students' abilities and skills.

Scientific principle

In the first part of the experiment, the students will experimentally investigate one of the most important properties of light, its linear propagation in a homogeneous medium. This regularity will also be used to substantiate the experimental result in the second partial experiment, thus opening up the methodological path for dealing with important technical applications of rectilinear light propagation.

Other teacher information (2/3)

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Learning objective

In the first part of the experiment, the students will experimentally investigate one of the most important properties of light, its linear propagation in a homogeneous medium. This regularity will also be used to substantiate the experimental result in the second partial experiment, thus opening up the methodological path for dealing with important technical applications of rectilinear light propagation.

Tasks

1. Observation and sketching of light propagation
2. Observation of the light propagation by means of the sighting method

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Other teacher information (3/3)

Ensure that the position of the light box is not changed during the individual tests (mark the opening and the front end of the light box with a pencil on the paper), if necessary hold the light box in place.

The second partial experiment shows a slight divergence of the light behind the three-slit diaphragm due to the deliberate omission of the condenser lens. The students should therefore mark

Safety instructions

- Halogen lamps become warm during prolonged use
- Avoid looking directly into the light source

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Student Information

Motivation

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Fluorescent tube

Light

We need it to see objects.

It has a source and spreads out from it. But how does this spreading happen? Which path does the light take from the transmitter, the source, to the receiver?

You will find an answer to this question in this experiment.

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Tasks

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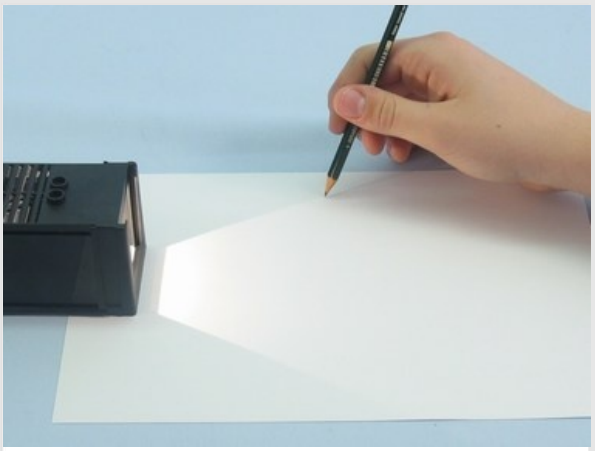

Experiment set-up

1. Observation and sketching of light propagation
2. Observation of the light propagation by means of the sighting method

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Equipment

Position	Material	Item No.	Quantity
1	Light box, halogen 12V/20 W	09801-00	1
2	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Procedure (1/7)

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Connecting the light box

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

Procedure (2/7)

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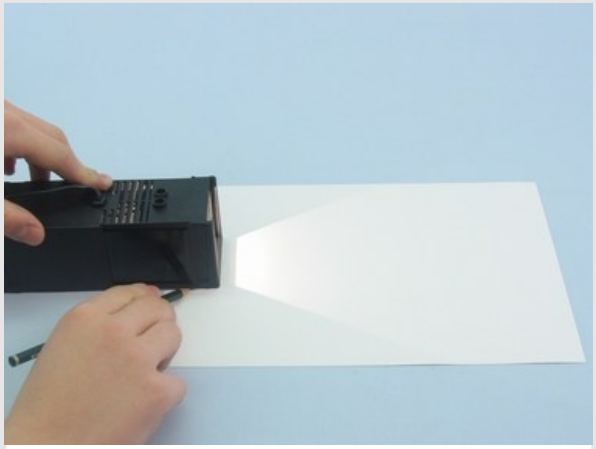

Using the light box

1. regularity of light propagation

- Observe the light coming from the experimental lamp and mark with 3 crosses each the lower and upper edge of the light beam.
- Connect the matching crosses and hatch the area of the light beam with the pencil.
- How do the light beam limitations work? Write down your observations in the protocol starting on slide 18.

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Procedure (3/7)

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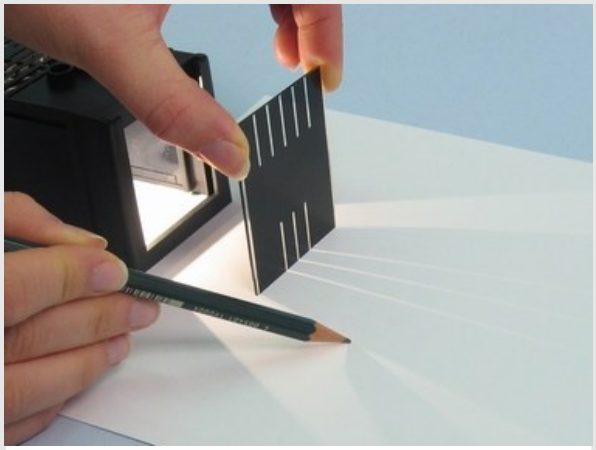

Follow the path of the light

- Use the back of the sheet of paper and place the light box on the sheet as before. Mark the position of the light box with the pencil.
- Hold the three-slit diaphragm in the light path of the large light beam approx. 2 cm in front of the light box.
- Observe the course of the light in front and behind the aperture.
- Mark each edge of the two wide light beams and each visible narrow light beam with three crosses.

Procedure (4/7)

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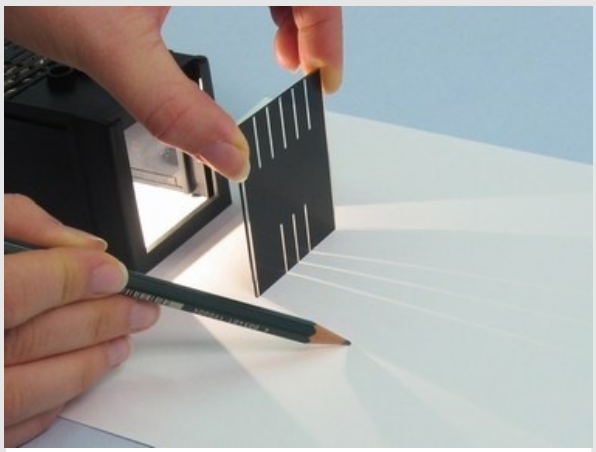

Follow the path of the light

- Connect all matching crosses with pencil strokes.
- Hatch the two wide light beams with a yellow coloured pencil.
- Switch off the power supply and remove the light box from the paper.

How do the edges of the wide light beams and the narrow light beams run? Note your observations in the protocol.

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Procedure (5/7)

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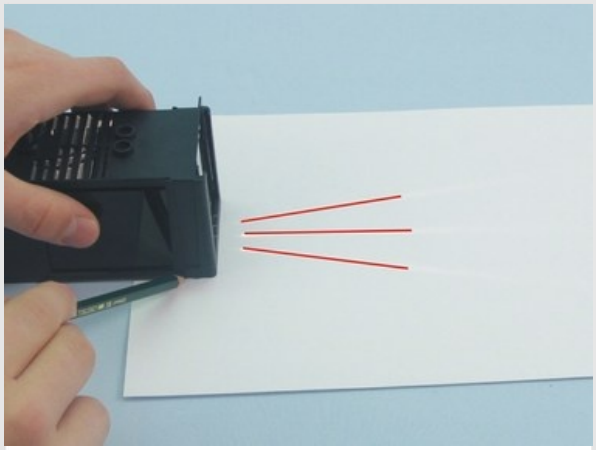

Position of the light box

Sighting method

- Insert the three-slit diaphragm into the light box on the lamp side and place the light box on the edge of a new sheet of paper. Mark the position of the light box.
- Switch on the power supply unit.

Procedure (6/7)

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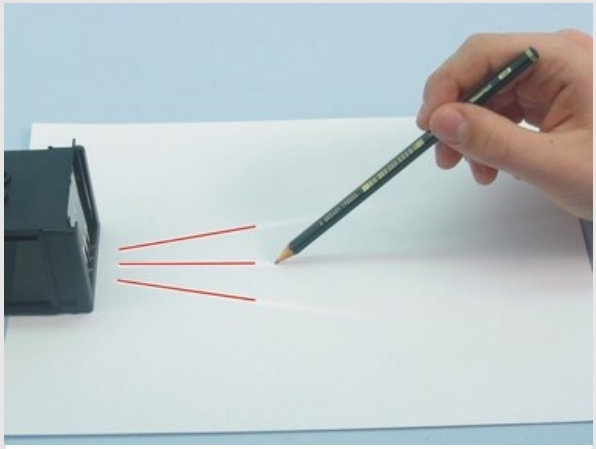

Centre beam

- Mark the central aperture and the course of the central narrow light beam.

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Procedure (7/7)

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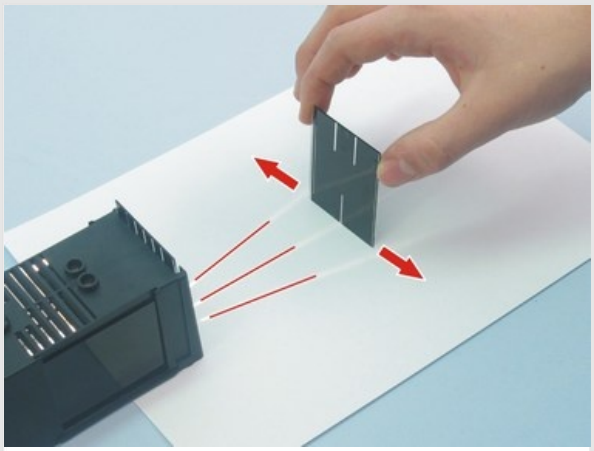

Sighting method

- Hold the slit diaphragm in the light path at a distance of approx. 8 cm from the light box. Move the single-column diaphragm transversely until the central opening of the three-column diaphragm can be seen exactly through the opening of the single-column diaphragm.
- Mark exactly the position of the second, hand-held aperture, especially the position of the aperture opening. Connect the pencil crosses that indicate the light path.
- Compare the light path with the position of the aperture of the single aperture and record your observations.

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Report

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Observation - Part 1

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Write down your observations for the first part of the experiment:

When using the experimental lamp without shade, the course of the light beam limitations

- ○ rectilinear
- ○ straightforward

Check

When using the experimental lamp without shade, the course of the light beam limitations

- ○ striving towards each other
- ○ parallel
- ○ diverging

Check

Observation - Part 1

PHYWE

Write down your observations for the first part of the experiment:

When using the experimental luminaire with three-slit shade, the course of the edges of the wide light beams

- ○ rectilinear
- ○ straightforward
- ○ striving towards each other

Check

When using the experimental luminaire with three-slit shade, the course of the edges of the narrow light beams

- ○ rectilinear
- ○ diverging
- ○ straightforward

Check

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Observation - Part 2

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Write down your observations for the second part of the experiment.

The pencil crosses are on a _____ line.

The aperture of the single gap diaphragm is exactly _____ this straight line.

Check

Task 1

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Compare the test results in the first task.

What differences and similarities do you notice?

The _____ wide and the _____ narrow light beams on the right half of the picture were _____ out of the light cone.
They are also _____ and run _____, i.e. they diverge.

three
two
apart
blanked
straight

Check

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Task 2

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What law can you formulate about the propagation of light?

The light spreads out [ ].

Check

Task 3

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Try to give a reason for your observation results in the sighting method.

Since the light from the [ ] first passes through the center slit of the [ ] and then through the aperture of the [ ], both must be on a [ ] line as the light propagates [ ]. This has already been confirmed by the experiment.

light source
single-aperture
triple-aperture
straight
straight

Check

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Task 4

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Think of applications from technology for the regularity you have found and give two examples.

Task 4

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Think of applications from technology for the regularity you have found and give two examples.

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