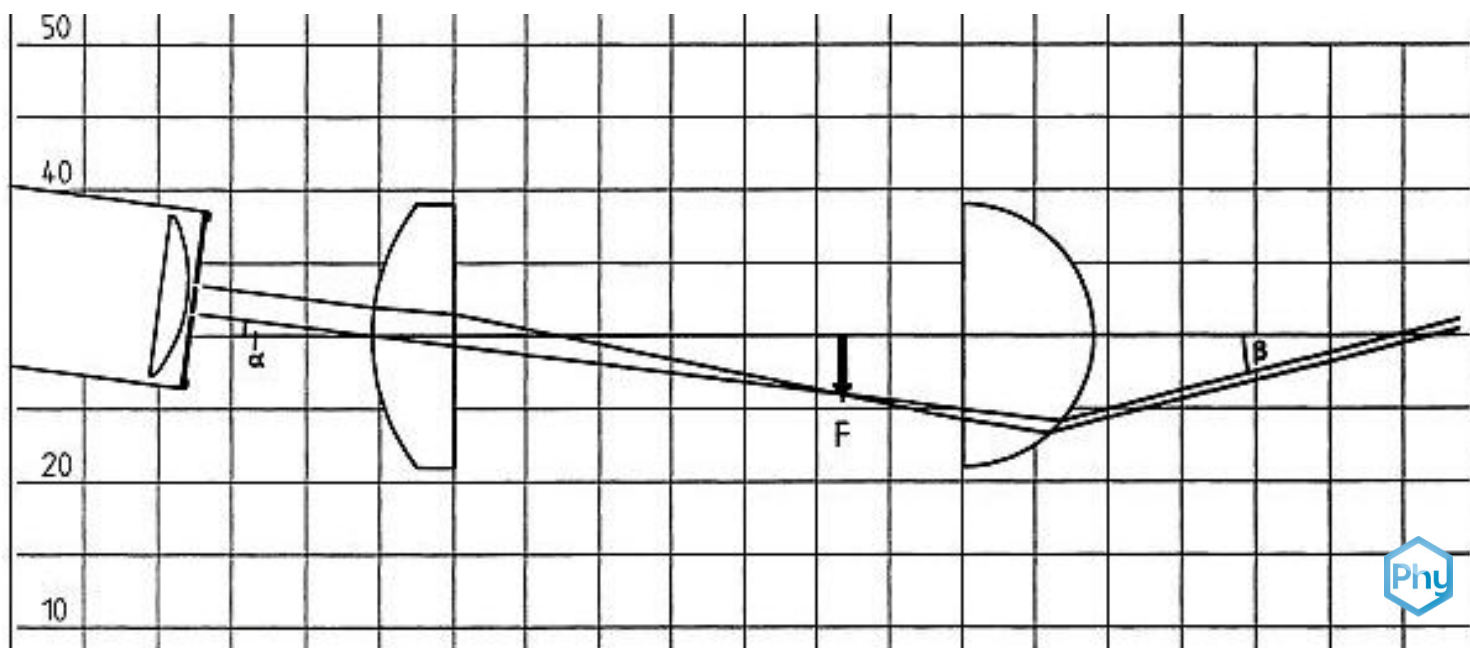


The astronomical telescope



The astronomical telescope (after Kepler)

Physics

Light & Optics

Optical devices & lenses



Difficulty level

easy



Group size

-



Preparation time

10 minutes



Execution time

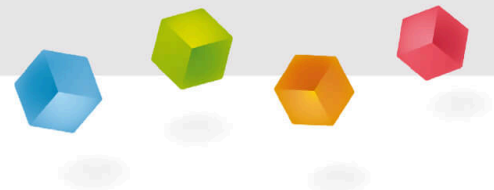
10 minutes

This content can also be found online at:



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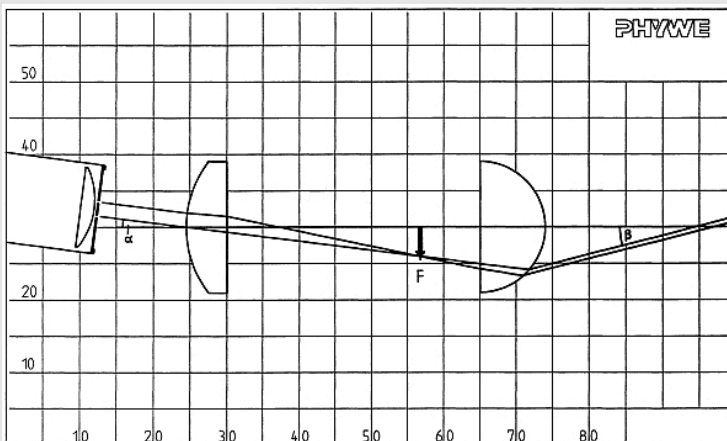
PHYWE



Teacher information

Application

PHYWE



Experimental set-up:

2-slit diaphragm two converging lenses

This experiment is about the function of a classical astronomical telescope in Kepler design.

The converging lenses are positioned in such a way that the angle of vision is significantly enlarged.

The focal points of the two converging lenses coincide, allowing a distant point to be magnified.

The entire system creates a virtual inverted image.

Other teacher information (1/2)

PHYWE

Prior knowledge



Students need prior knowledge of imaging optics, with collecting and diverging lenses and the spectral colours of light.

Principle



The construction and mode of operation of an astronomical telescope will be demonstrated.

Other teacher information (2/2)

PHYWE

Learning objective



Students should understand the application of different lenses in technical developments.

Tasks



The students should make observations and gather knowledge about the experimental set-up.

Safety instructions

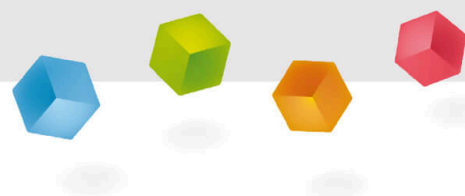
PHYWE



- The general instructions for safe experimentation in science lessons apply to this experiment.

PHYWE

Student information



Motivation

PHYWE



Antique astronomical telescope

Astronomical telescopes have been used for many centuries to explore and understand the universe.

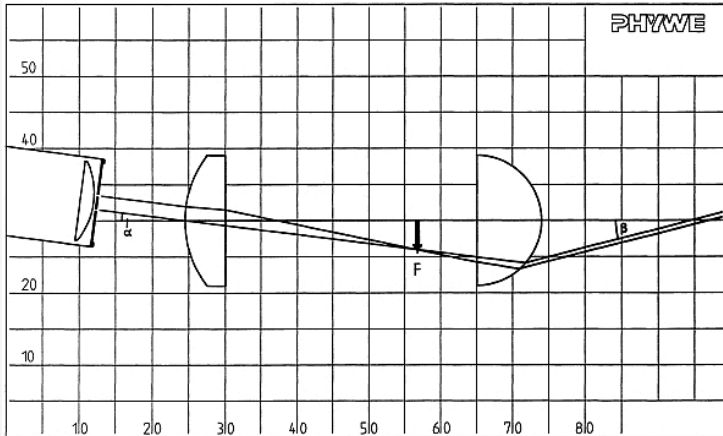
The classic telescope is based on a simple construction in which various lenses are used.

The underlying experiment is intended to explain the construction of such a telescope.

Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	Halogen lamp for experiments, 12V/50W, with magnetic base	08270-20	1
3	Optical block, semicircular, magnet held	08270-01	1
4	Opt. block, planoconvex, magn.held	08270-02	2
5	PHYWE Multitap transformer DC: 2/4/6/8/10/12 V, 5 A / AC: 2/4/6/8/10/12/14 V, 5 A	13533-93	1
6	G-clamp	02014-01	2

Set-up and Procedure (1/2)

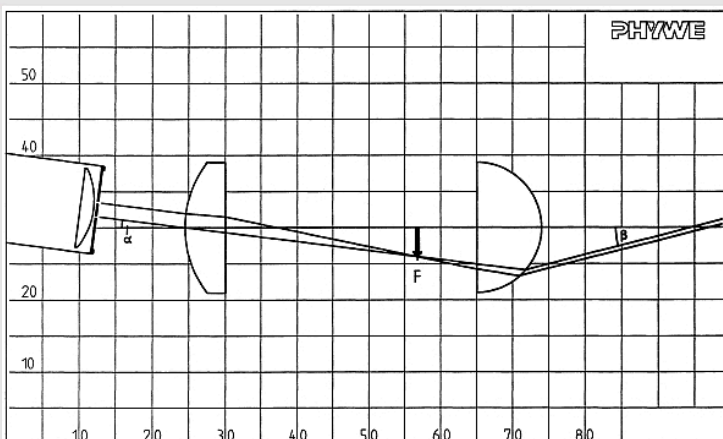


2-slit diaphragm with two converging lenses

- Set optical axis on adhesive panel
- Place the plano-convex and semi-circular bodies on the optical axis as shown in the illustration.
- Position the lamp with the 2-slit diaphragm so that the two rays form a small angle α with the optical axis and emerge parallel from the second lens (semicircle); readjust the second lens if necessary.

Set-up and Procedure (1/2)

PHYWE

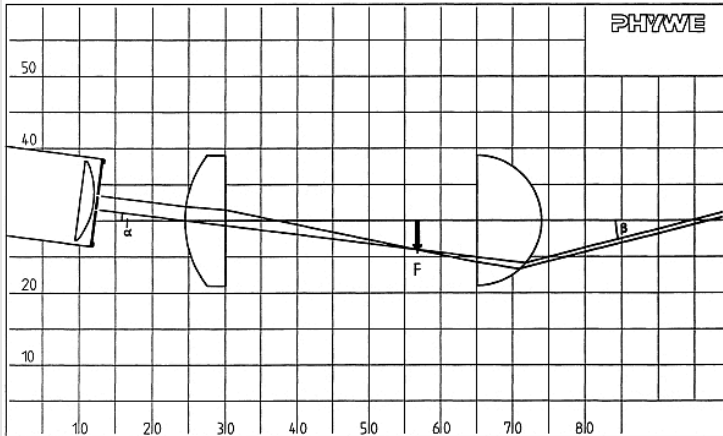


2-slit diaphragm with two converging lenses

- Set optical axis on adhesive panel
- Place the plano-convex and semi-circular bodies on the optical axis as shown in the illustration.
- Position the lamp with the 2-slit diaphragm so that the two rays form a small angle α with the optical axis and emerge parallel from the second lens (semicircle); readjust the second lens if necessary.

Set-up and Procedure (2/2)

PHYWE

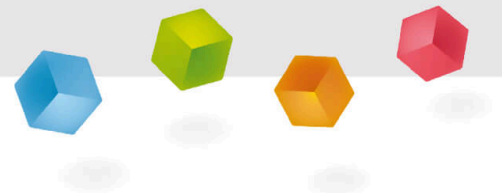


2-slit diaphragm with two converging lenses

- Observe the course of the rays
- Mark angles α and β
- Compare angle α with the angle β which the two rays beyond the second lens again form parallel with the optical axis.

PHYWE

Report



Task 1

PHYWE

Put the correct words into the gaps!

A distant object point is imaged by the first [] in such a way that the [] is equal to the focal length of the lens. By means of a second converging lens with a smaller [] and the [] at the same position, a [] enlarged image is produced from the [] intermediate image.

virtual

focal length

collecting lens

real

focal point

image width

☒ Check

Task 2

PHYWE

The experimental set-up significantly reduces the angle of vision ($\alpha > \beta$)

☐ True☐ False☒ ☐ ☐ Review

The light rays of very distant objects can be considered (almost) parallel.

☐ True☐ False☒ ☐ ☐ Review

Task 3

PHYWE



The astronomical or Keplerian telescope consists on the object side of a lens (or lens system) with a large focal length,

called a tripod.

called a lens.

called a magnifying glass.