

OPTICS TRADE

Refracting Telescopes

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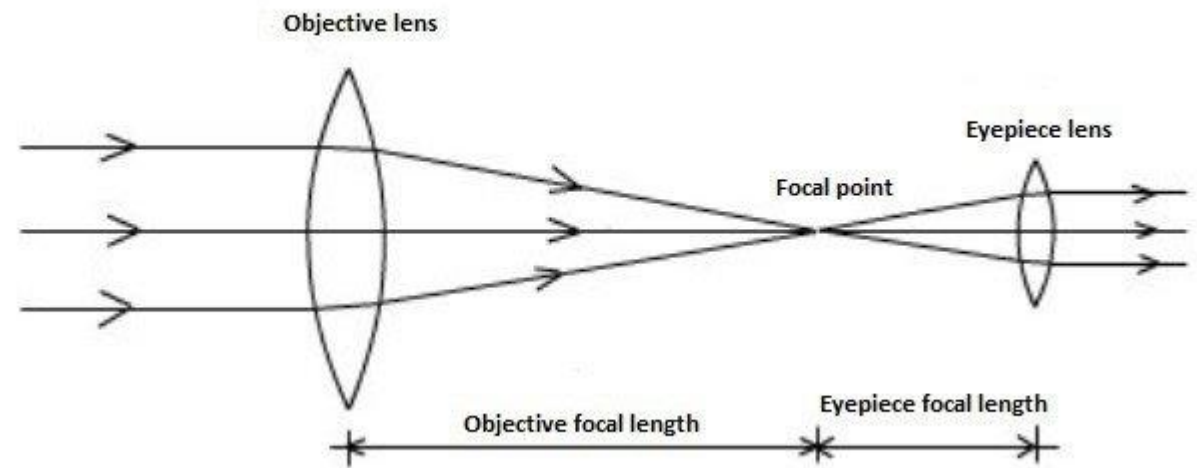
- Refractor → The first-ever built telescope
- Telescope with the most recognizable shape
- It is a type of telescope with a **long** tube and a combination of **glass** lens at its objective (**objective lens**) and a second glass at its eyepiece (**eyepiece lens**).

DESIGN

- Refractors are very **rugged** and **sturdy** — it is hard for the optics to come out of the **alignment**.
- Because of a long tube, the eyepiece is at the lower end of the telescope → **high tripod** is required



PATH OF THE LIGHT



- Light enters at the upper end, where it is **refracted** (bent) as it passes through the lens → light travels in a **straight** path through a vacuum → focuses on a single point (called **focal point**) at the bottom of the telescope
- The image is **magnified** with the set of the **eyepiece** lens
- The image **size** depends on the focal length

OPTICAL TUBE

- A significant advantage of a refractor telescope is its **closed** tube

This is good for two reasons:

- Firstly, the glass surface is **air sealed**, which means that it is protected against dust, dirt, and humidity → doesn't need much cleaning
- Secondly, the image is steadier and sharper than on other types of telescopes → the effects of changing temperatures are eliminated.

DISADVANTAGES

Chromatic aberration

- Every color has a different wavelength → When passing through the lens, every color refracts at **different angles**
- Chromatic aberration occurs because the lens is unable to focus all colors on a **single** point (a rainbow of colors around the image)

Reducing chromatic aberration

- In the 17th century, they used to build telescopes with very **long tubes** — very long focal length diminishes chromatic aberration
- In modern refractors, an achromatic or apochromatic lens is added to reduce chromatic aberration

- Compared to other types of telescopes, refractors have a **small aperture** → don't collect as much light as telescopes of a different design
- With refracting telescopes, the lens can only be supported at the ends of an optical tube. If the lens is too big, it can happen that the center of the lens sags due to gravity — image is **distorted**
- **Lunar** and **planetary** observations
- They produce high-contrast images, but there is not enough **light-gathering** power for observing the “**deep-sky objects**” such as **nebulas** and **galaxies**



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