



كلية المستقبل الجامعة  
قسم الفيزياء الطبية  
المرحلة الثانية

# Medical Physics

## Optics

### Lecture Five

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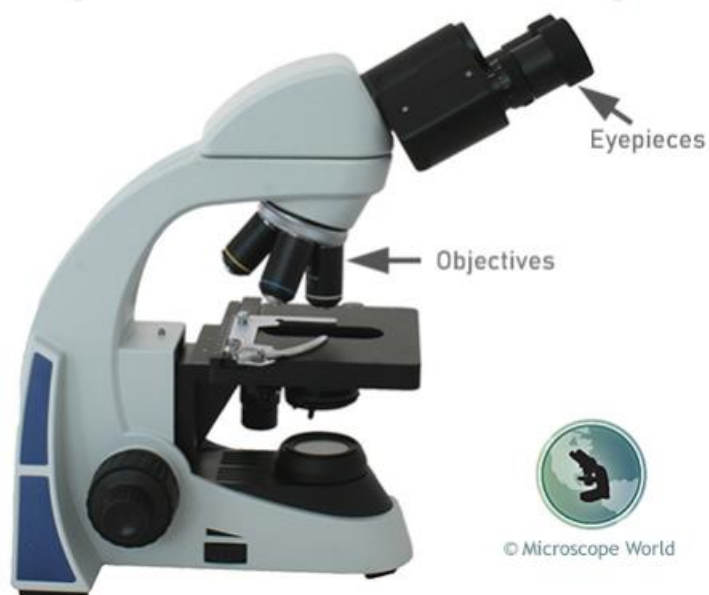
## **Properties of simple microscope :**

- 1- Simple microscope has one magnification power to magnify objects .
- 2- Natural source of light .
- 3- Simple microscope has one convex lens .
- 4- Level of magnification in simple microscope is one level only .
- 5- Magnifying power up to 300X .

## **Properties of compound microscope :**

- 1- Compound microscope has multiple magnification power (3-5) to magnify objects .
- 2- Illuminator source of light .
- 3- Compound microscope has multiple lens .
- 4- Level of magnification in compound microscope is higher-level.
- 5- Magnifying power 2,000X .

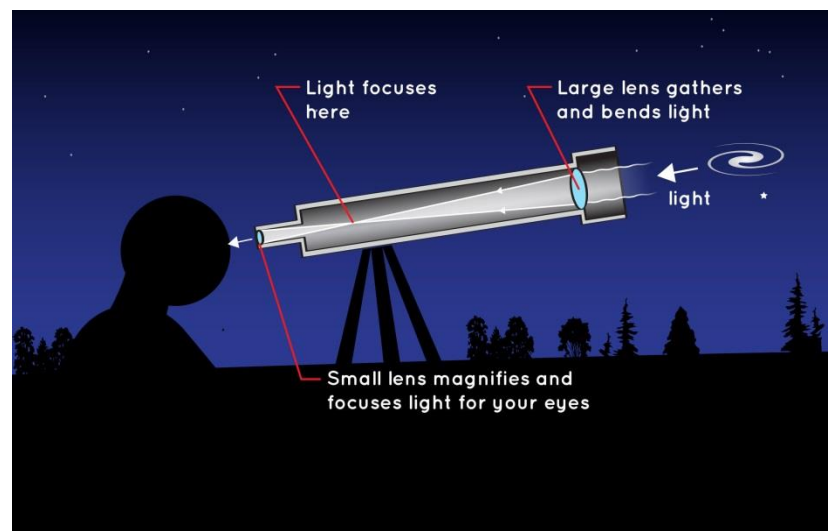
## Compound Microscope



## Telescope :

A telescope is an optical instrument using lenses, curved mirrors, or a combination of both to observe distant objects, or various devices used to observe distant objects by their emission, absorption, or reflection of electromagnetic radiation . The first known practical telescopes were refracting telescopes invented in the Netherlands by using glass lenses, they were used for both terrestrial applications and astronomy.

The reflecting telescope, which uses mirrors to collect and focus light, many new types of telescopes were invented, including radio telescopes in the 1930s and infrared telescopes in the 1960s. The word telescope now refers to a wide range of instruments capable of detecting different regions of the electromagnetic spectrum, and in some cases other types of detectors.

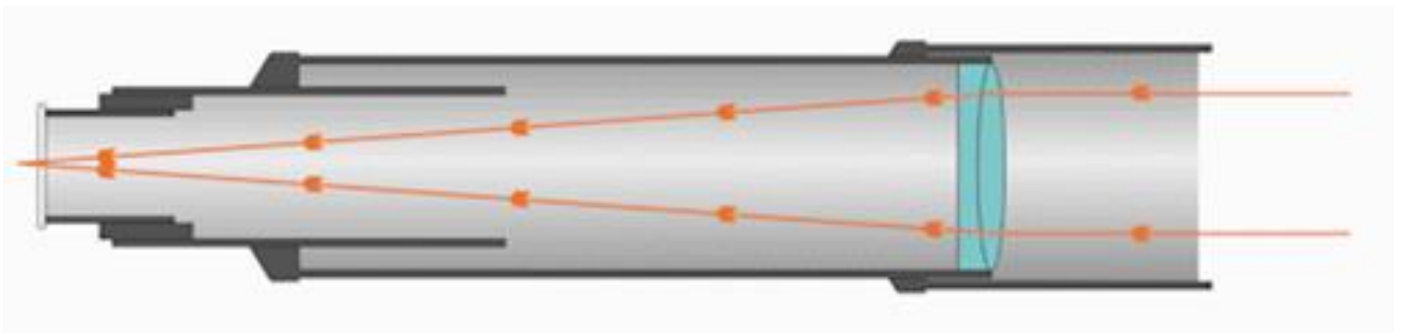


## **Catagories of Telescope :**

Most any telescope will fall into one of three catagories: Refractors, Reflectors and Catadioptric or compound scopes which use a combination of both lenses and mirrors.

### **Refractors Telescope :**

which use lenses to bend light into focus, utilize specially designed lenses to focus the light into an image. They are usually long relative to their size, as the light must flow in a straight path through the telescope tube to the eyepiece.



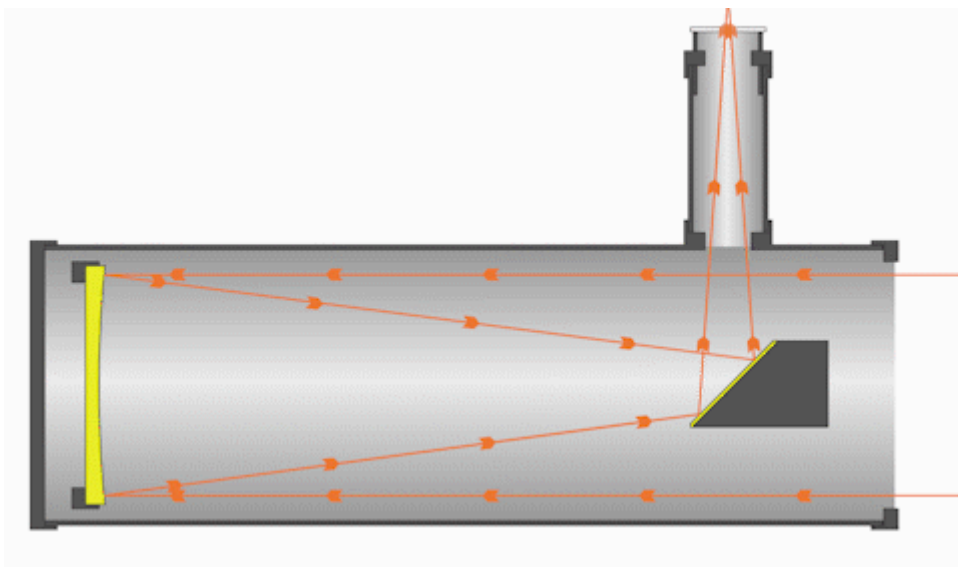
The larger the lenses in a refracting telescope, the longer the optical tube has to be to bring the image into focus. The length and size of lens of a refractor combined with the fact that large lenses can be difficult and expensive for glassmakers to manufacture at high quality, means that larger refractors can get rather expensive.



## Reflectors Telescope :

Reflectors telescope use mirrors that reflect light into focus, which causes light to reflect at various angles within the optical tube, extending the overall light path.

This often causes reflectors to be shorter than refractors of the same aperture, as the light doesn't need to flow in a straight line to move the same distance. When combined with how manufacturing large mirrors is often cheaper than manufacturing large lenses, it's fairly common for reflectors to be much less expensive than refractors at larger apertures .

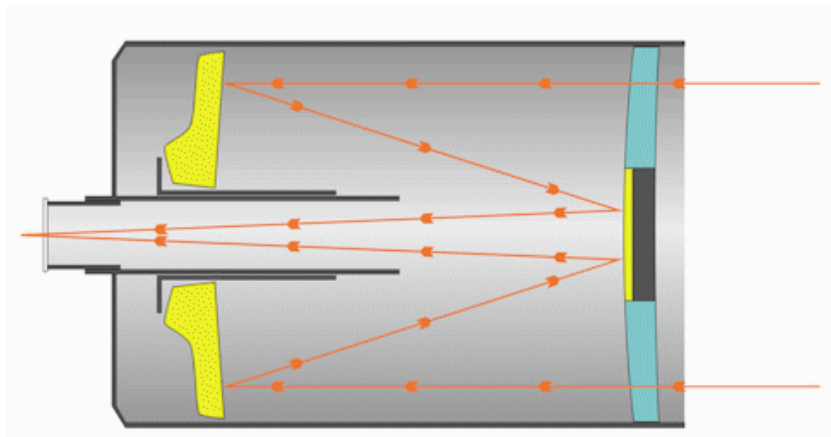


Additionally, a reflector will sometimes require a process called collimation, which consists of adjusting the reflector's mirrors to make sure they stay in proper alignment with each other.



## Catadioptric or compound scopes Telescope :

which use a combination of both lenses and mirrors, combine the optical benefits of both lenses and mirrors into a compact, convenient package, being smaller and more portable than either refractors or reflectors of the same aperture. This is made possible by the corrector plate that folds the light path and the curved secondary mirror that magnifies the light internally.



Since it uses mirrors much like a reflector, a catadioptric scope will require collimation. However, unlike with reflectors, this procedure needs to be performed far less frequently. If well taken-care of, a compound scope can go for years without requiring collimation .

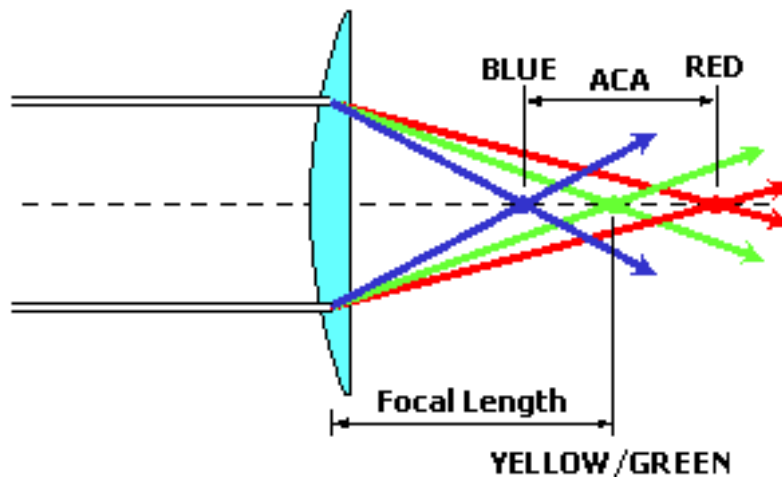
The catadioptrics' small size and portability give them a convenience not found in reflectors of the same class, making them a great investment for both beginners and experienced astronomers alike.



## Visible Color Fringing :

Depending on the type of lenses used for the optics, you may encounter visible color fringing at high magnifications. Also known as chromatic aberration .

**Chromatic Aberration:** is a form of chromatic aberration caused by the failure of a lens system to focus all colors at the same point. The amount of chromatic aberration depends on the dispersion of the glass. Chromatic aberration is visible as color fringing around areas of high contrast, such as edges, and occurs around the edges of the image frame in wide-angle shots .



### Reason Occur of Chromatic Aberration:

- 1- When the various colored wavelengths of light get split from each other and arrive at slightly different angles .
- 2- Showing up as an image with distinct coloration at the edges .
- 3- Most low-cost refractors are “doublets,” which may have color fringing, whereas “triplet” refractors are designed to eliminate this issue.

