



# TELESCOPES

## Telescopes An Overview





## Telescopes An Overview

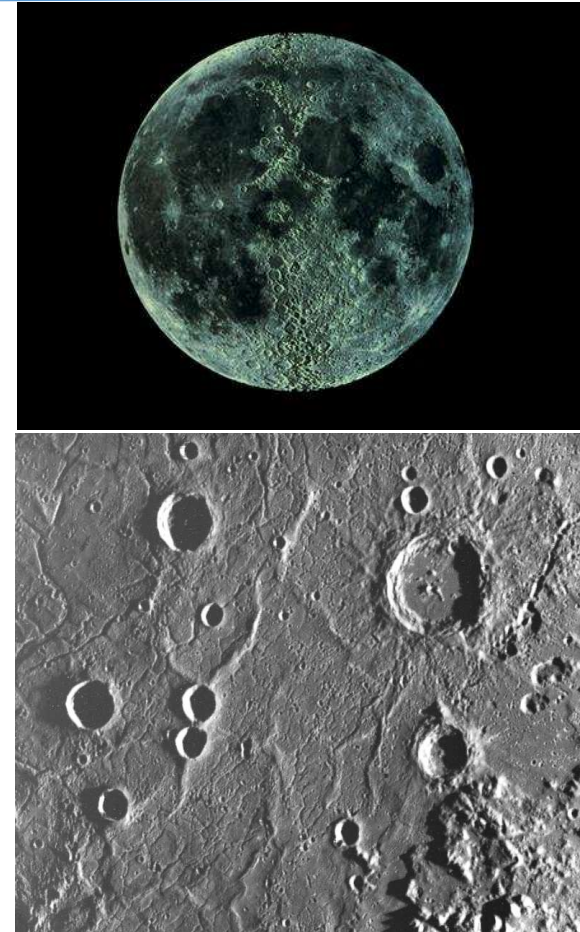
### Overview

This lesson provides a quick introduction into telescopes and some key terms to understanding their operation.

Most of the universe cannot be seen with the Mark-1 eyeball as the human eye is unable to see very faint objects with few notable exceptions:

- Galaxies (except Andromeda)
- 2 Planets (Uranus, Neptune)
- Spectra

Telescopes allow us to probe the Universe through a variety of different “eyes” that provide a greater understanding than is possible with just our eyes.



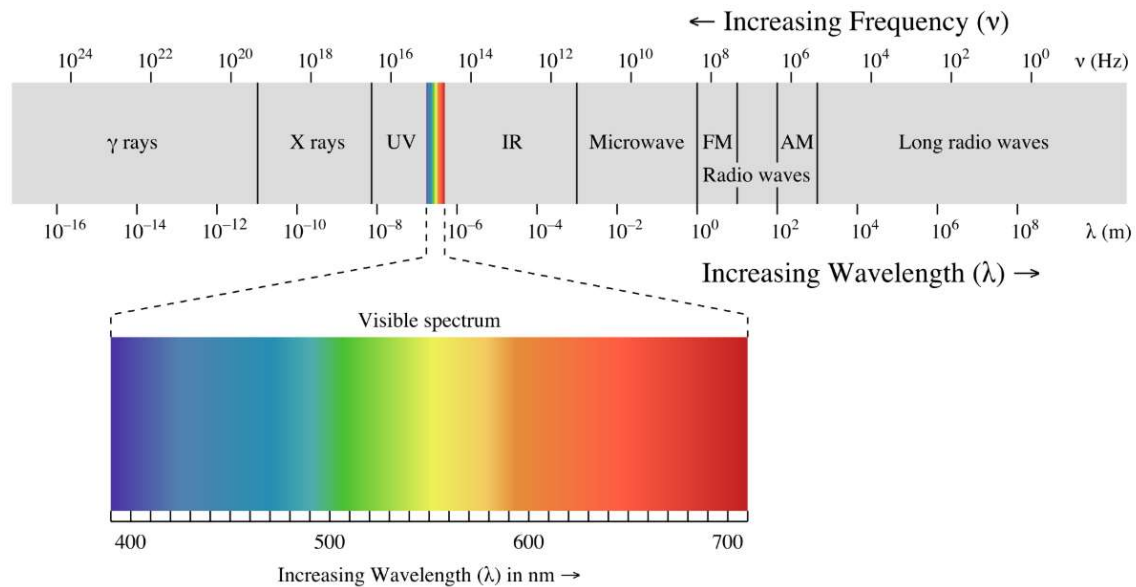


# Telescopes An Overview

## Telescopes Overview

Telescopes are tools used to gather light from objects in the Universe.

This includes visible light as well as light on either side of visual.



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## Telescopes An Overview

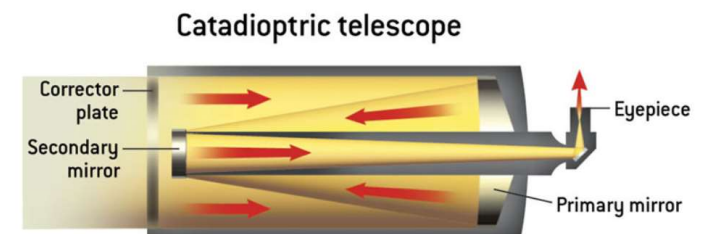
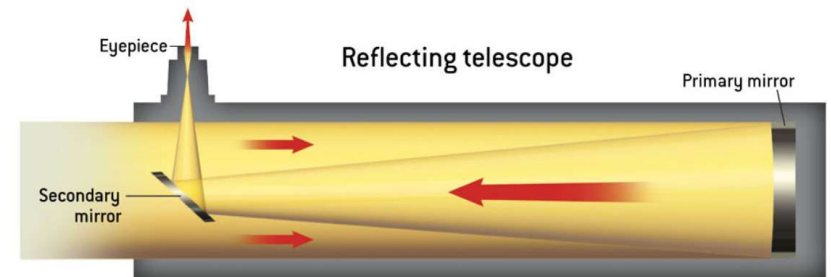
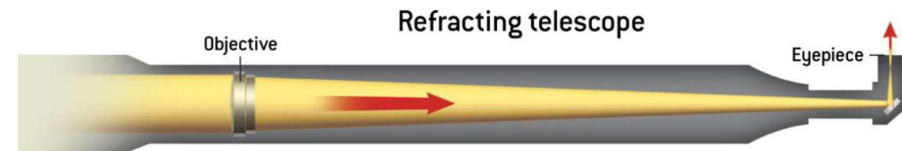
### Telescopes Types

There are two basic types of telescopes :

*Refractor:* Uses a lens to bend, or refract the light

*Reflector (and Catadioptric):* Uses a mirror to reflect the light

Both focus before the eyepiece, so the image in astronomical telescopes is upside down.





## Telescopes An Overview

### Aperture = Size = Light Gathering

Aperture (a.k.a. “How big is it”) refers to the size of the primary mirror.

The larger a scope is DOES NOT mean that objects will appear bigger.

Larger aperture ONLY means there is greater light gathering capability than smaller apertures.

Thus images look brighter, more detailed, and you will be able to see fainter objects.

Think of a telescope as a bucket sitting in a rain of photons: increasing the aperture (diameter) of a telescope its **light gathering power** (it can capture more photons in the same amount of time because it is bigger). I.e.

$$\text{LGP} \propto D^2$$

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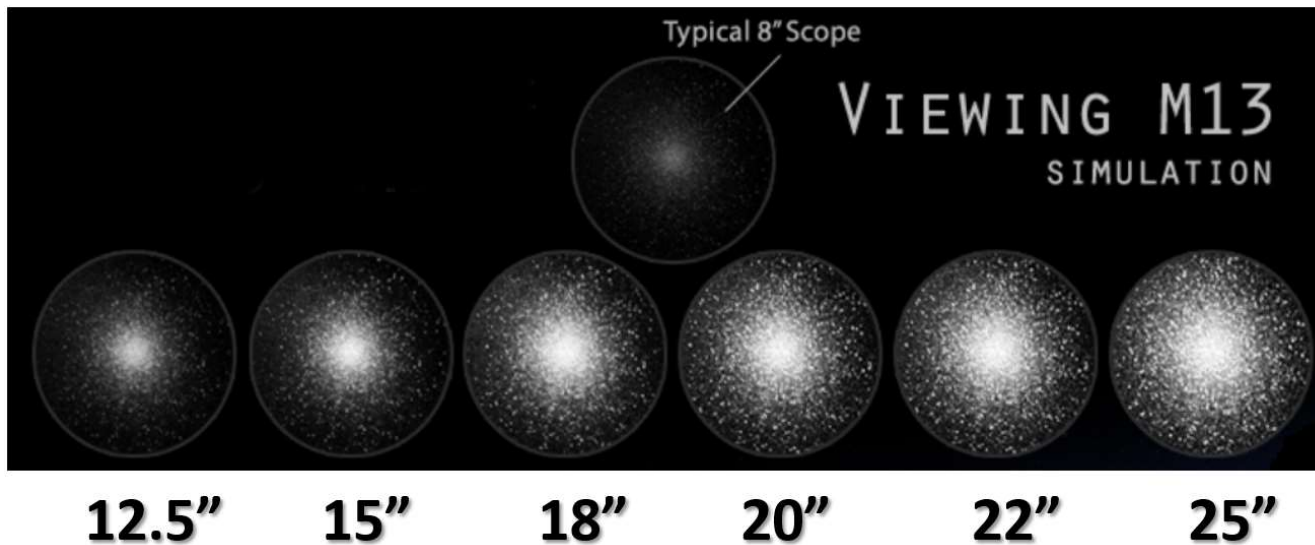


## Telescopes An Overview

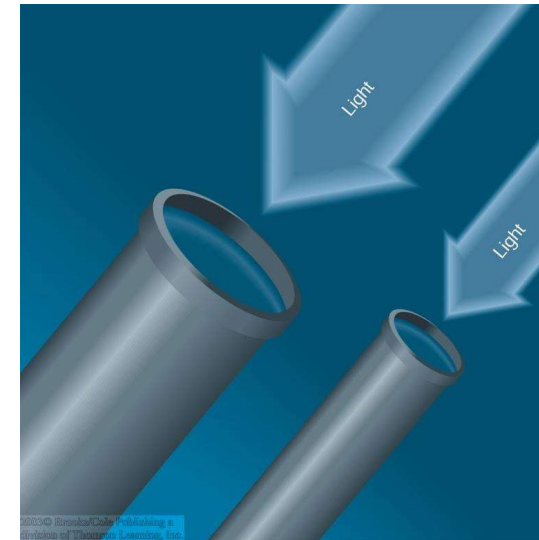
### Aperture = Size = Light Gathering

Remember: The size of the mirror (a.k.a. the Light Gathering Power, has NOTHING to do with how large an image appears in the eyepiece.

It only affects the amount of light that is incoming and thus the final clarity, resolution, appearance of the image you are viewing.



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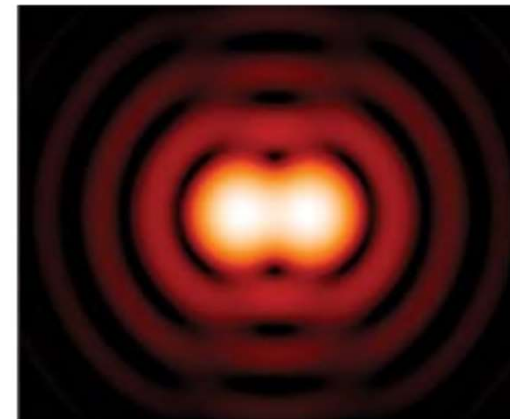
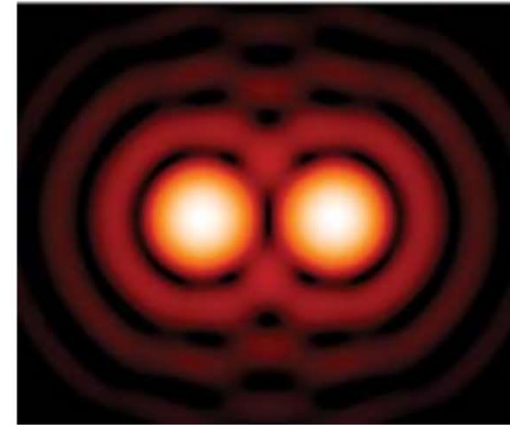




## Telescopes An Overview

### **Aperture = Size = Resolution**

Aperture also leads to greater resolution, or the ability to separate closely spaced objects. Ex. Double Stars.



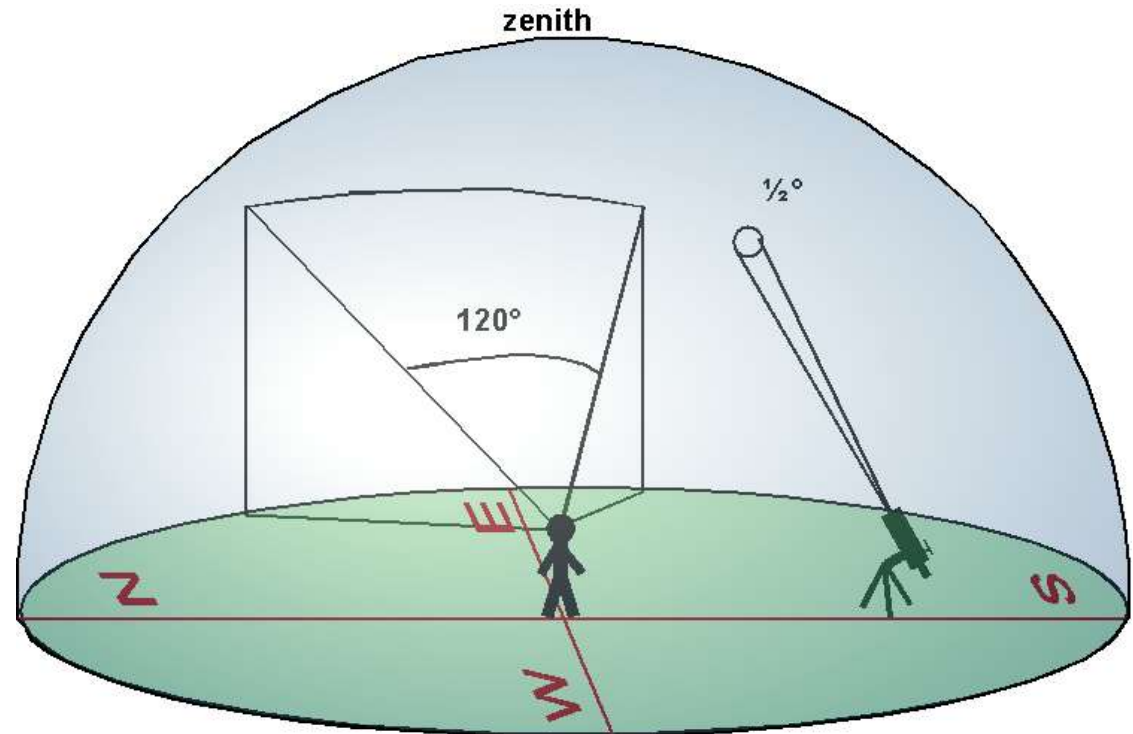


## Telescopes An Overview

### General Field of View

The eye can capture a wide field of view where as the telescope has a very narrow field of view.

For a better understanding of how we measure a telescope and CCD camera's field of view, review the video lesson: STARS – Angular Measurements on the Sky.





# Telescopes An Overview



## Telescope Demonstration

<http://astro.unl.edu/classaction/animations/telescopes/telescope10.html>

**Observing**

Aperture  
 8-inch    6-inch    4-inch

Eyepiece  
 40 mm    20 mm    10 mm

Target  
 Moon    Saturn    Cluster

Focus Adjustments: 3.0  
-10   10

Refracting Telescope

Field of View

**Readouts**

LGP = 840 (times that of the human eye)

Resolution = 0.56 arc-secs

$$\text{Magnification} = \frac{F_o}{F_e} = \frac{1400 \text{ mm}}{40 \text{ mm}} = 35$$

Field of View = 1.22°

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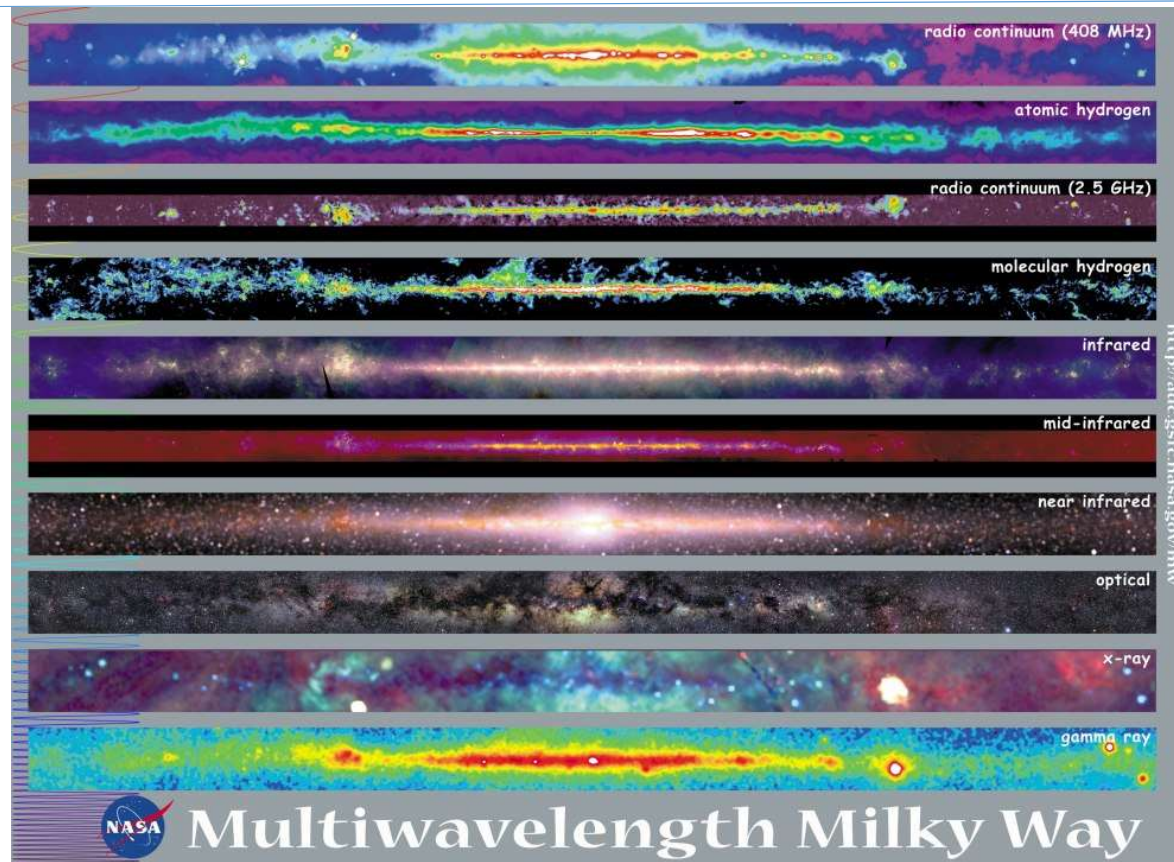
# Telescopes An Overview



## Different Telescopes for Different EM Radiation

The image to the right demonstrates the same view of the Milky Way through different parts of the EM Spectrum using different types of telescopes.

For more detail on these types of telescopes, consult the video lesson: TELESCOPES – Telescopes for Different Views of the Universe





## Telescopes An Overview

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***Questions?***



## Image Orientation

Images tend to reverse and flip based on the type of scope you are using and whether you are using a diagonal.

