CHAPTER 6 TELESCOPES: PORTALS OF DISCOVERY

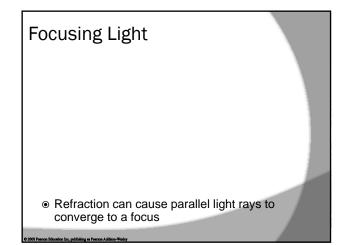
6.1 Eyes and Cameras: Everyday Light Sensors

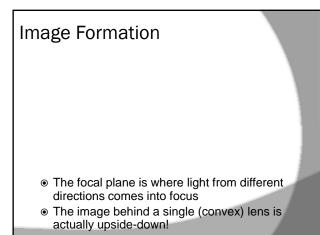
Our goals for learning:

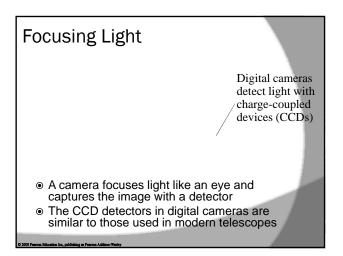
- How does your eye form an image?
- How do we record images?

Refraction

- Refraction is the bending of light when it passes from one substance into another
- Your eye uses refraction to focus light







What have we learned?

- How does your eye form an image?
 - It uses refraction to bend parallel light rays so that they form an image.
 - The image is in focus if the focal plane is at the retina.
- How do we record images?
 - Cameras focus light like your eye and record the image with a detector.
 - The detectors (CCDs) in digital cameras are like those used on modern telescopes

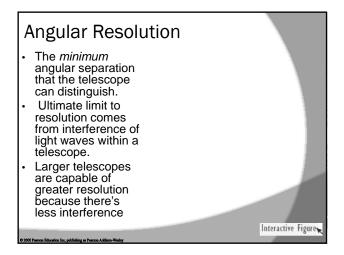
6.2 Telescopes: Giant Eyes

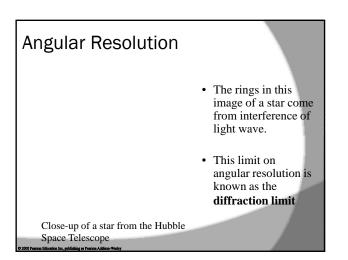
Our goals for learning:

- What are the two most important properties of a telescope?
- What are the two basic designs of telescopes?
- What do astronomers do with telescopes?

What are the two most important properties of a telescope?

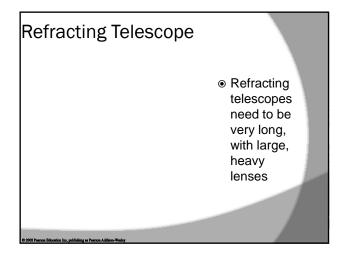
- 1. Light-collecting area: Telescopes with a larger collecting area can gather a greater amount of light in a shorter time.
- 2. Angular resolution: Telescopes that are larger are capable of taking images with greater detail.

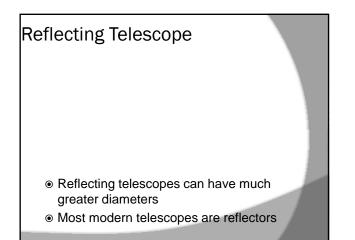




What are the two basic designs of telescopes?

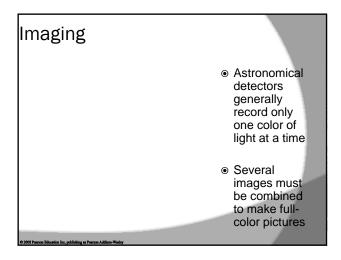
- **Refracting telescope:** Focuses light with lenses
- Reflecting telescope: Focuses light with mirrors

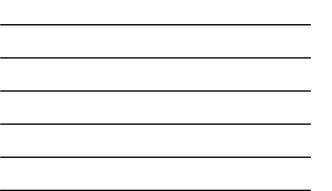


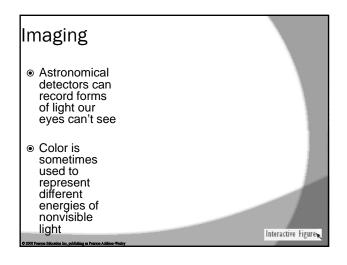


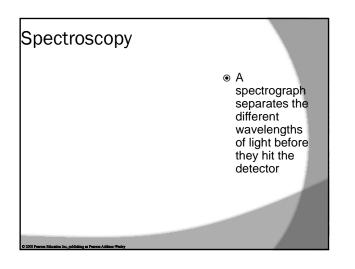
What do astronomers do with telescopes?

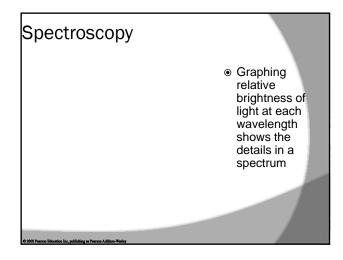
- Imaging: Taking pictures of the sky
- Spectroscopy: Breaking light into spectra
- **Timing:** Measuring how light output varies with time

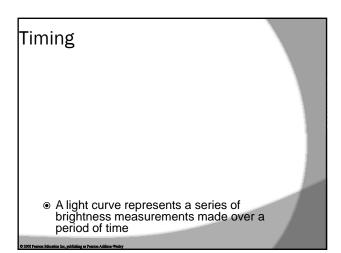












Want to buy your own telescope?

- Buy binoculars first (e.g. 7x35) you get much more for the same money.
- Ignore magnification (sales pitch!)
- Notice: aperture size, optical quality, portability.
- Consumer research: Astronomy, Sky & Tel, Mercury. Astronomy clubs.

What have we learned?

- What are the two most important properties of a telescope?
 - Collecting area determines how much light a telescope can gather
 - Angular resolution is the minimum angular separation a telescope can distinguish
- What are the two basic designs of telescopes?
 - Refracting telescopes focus light with lenses
 - Reflecting telescopes focus light with mirrors
 - The vast majority of professional telescopes are reflectors

What have we learned?

- What do astronomers do with telescopes?Imaging
 - Spectroscopy
 - Timing

6.3 Telescopes and the Atmosphere

Our goals for learning:

- How does Earth's atmosphere affect ground-based observations?
- Why do we put telescopes into space?

How does Earth's atmosphere affect ground-based observations?

- The best ground-based sites for astronomical observing are
 - Calm (not too windy)
 - High (less atmosphere to see through)
 - Dark (far from city lights)

Twinkling and Turbulence

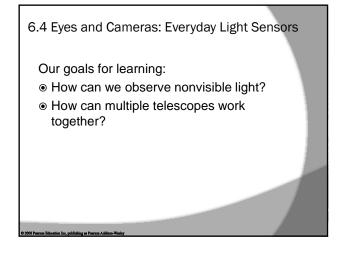
Dry (few cloudy nights)

Turbulent air flow in Earth's atmosphere

distorts our view, causing stars to appear to twinkle

What have learned?

- How does Earth's atmosphere affect ground-based observations?
 - Telescope sites are chosen to minimize the problems of light pollution, atmospheric turbulence, and bad weather.
- Why do we put telescopes into space?
 - Forms of light other than radio and visible do not pass through Earth's atmosphere.
 - Also, much sharper images are possible because there is no turbulence.





 A radio telescope is like a giant mirror that reflects radio waves to a focus

