

Telescopes 1

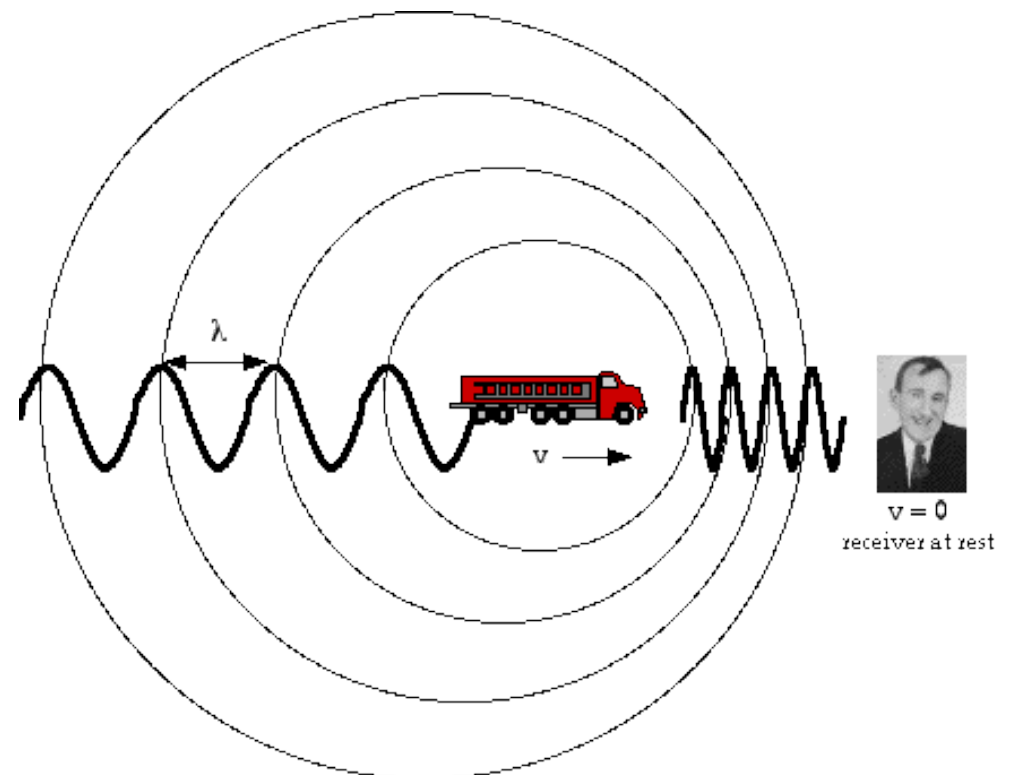
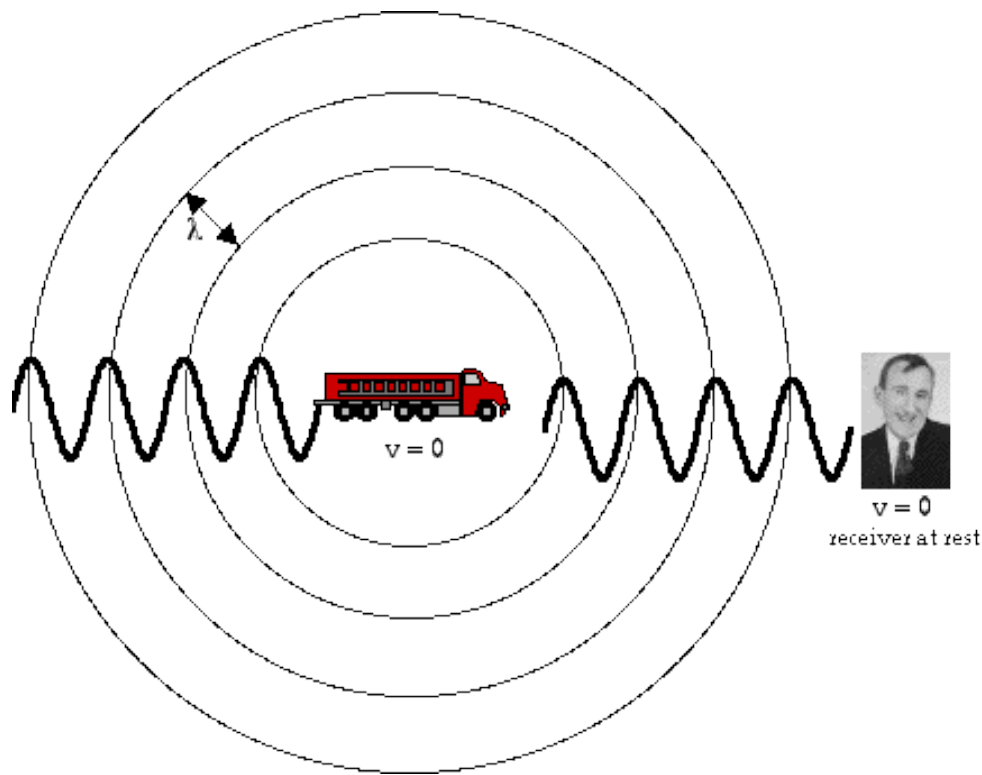
10/14/2009

Opening Discussion

- <http://www.youtube.com/watch?v=Ru80tKwCLcg>
- Do you have any questions about the quiz?
- Have you seen anything interesting in the news?
- What did we talk about last class?

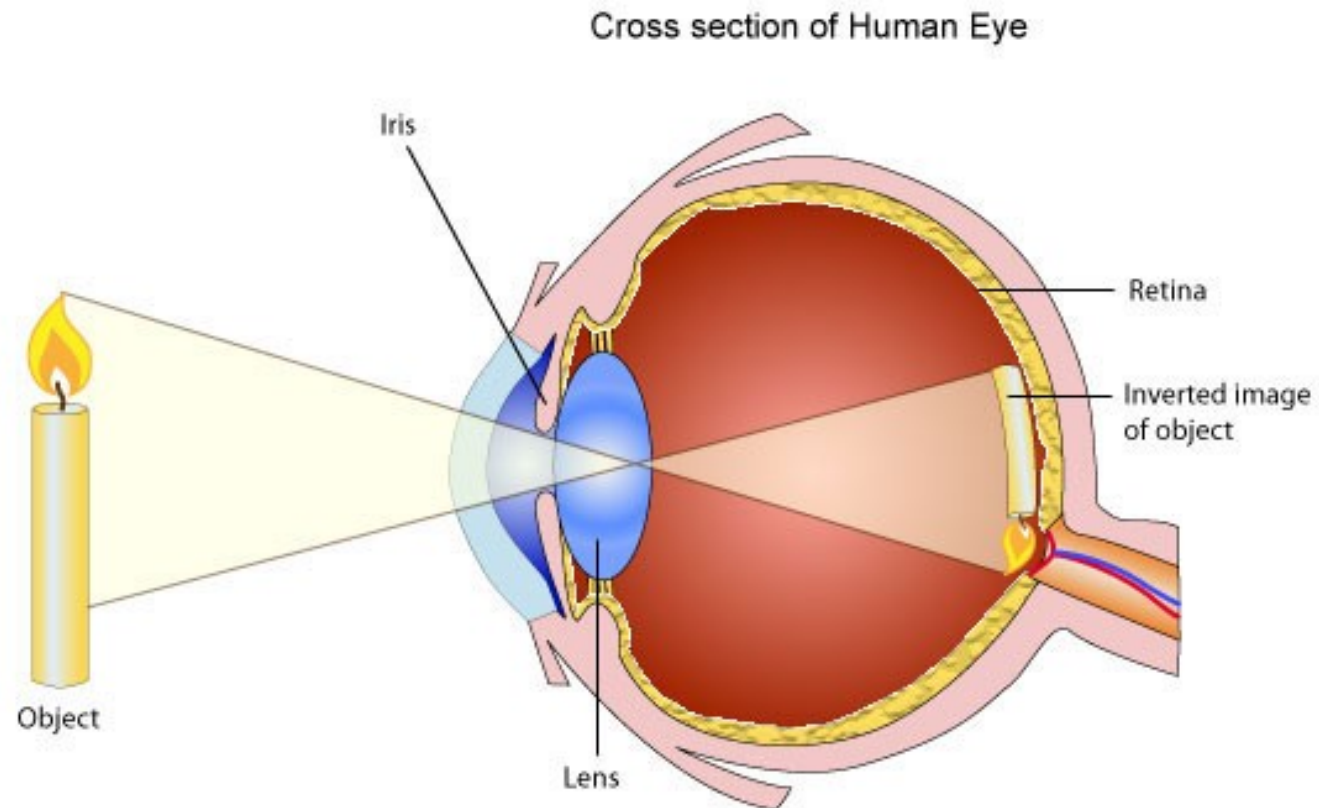
Doppler Shift Revisited

- Let's take a moment to revisit the concept of the Doppler shift.



Eyes and Cameras

- Eyes and cameras both work by using a lens to focus light onto a “detector”.



Telescopes

- Telescopes are like giant eyes that collect a lot more light and allow us to see a lot more detail.
- There are two main properties of telescopes:
 - Light collecting area – how much light the telescope gathers.
 - Angular resolution – how small of details it can resolve.
- Note that magnification is not one of them.

Angular Resolution

- This is something we have seen before, but is worth revisiting.

$$\textit{angularSeparation} = \textit{physicalSeparation} \times \frac{360^\circ}{2\pi \times \textit{distance}}$$

- For telescopes we often think about arcseconds so we can use the fact that there are 3600 arcseconds in a degree to get this.

$$\textit{angularSeparation} = 206,265'' \times \frac{\textit{physicalSeparation}}{\textit{distance}}$$

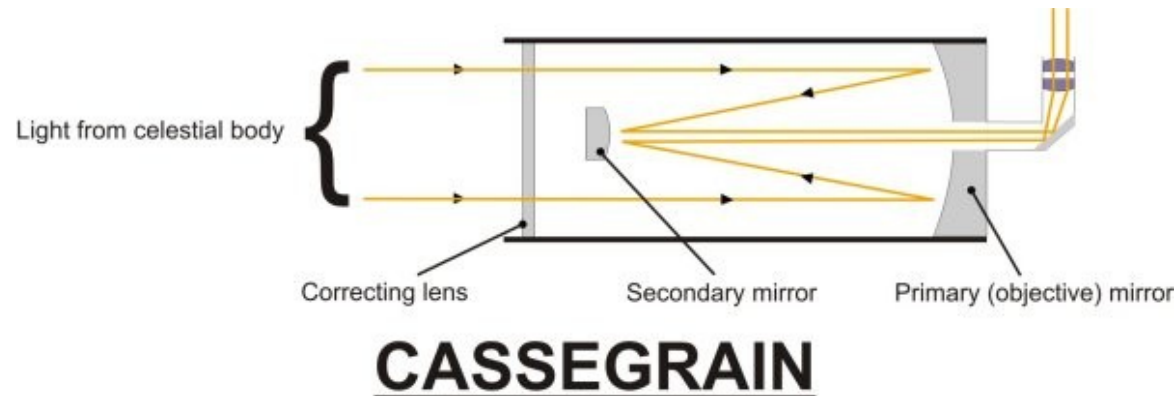
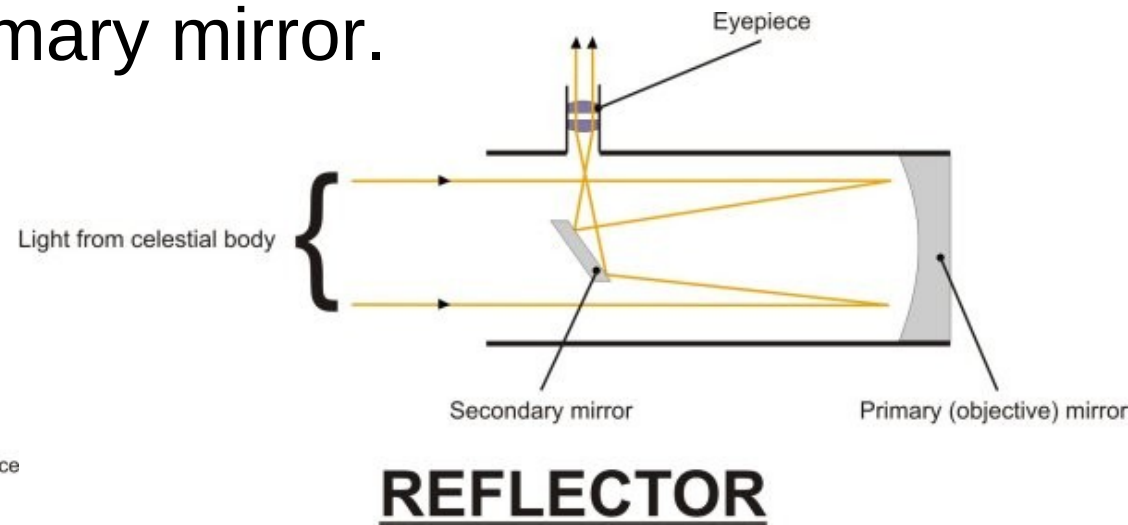
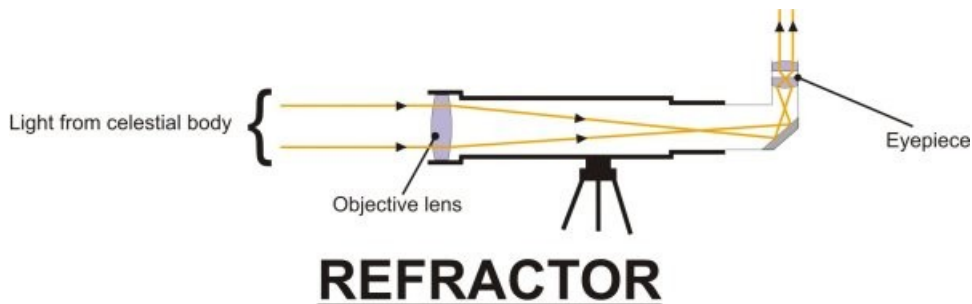
Diffraction Limit

- Because of the wave nature of light, there is a physical limit to the resolution you can see in a given wavelength with a given aperture size.

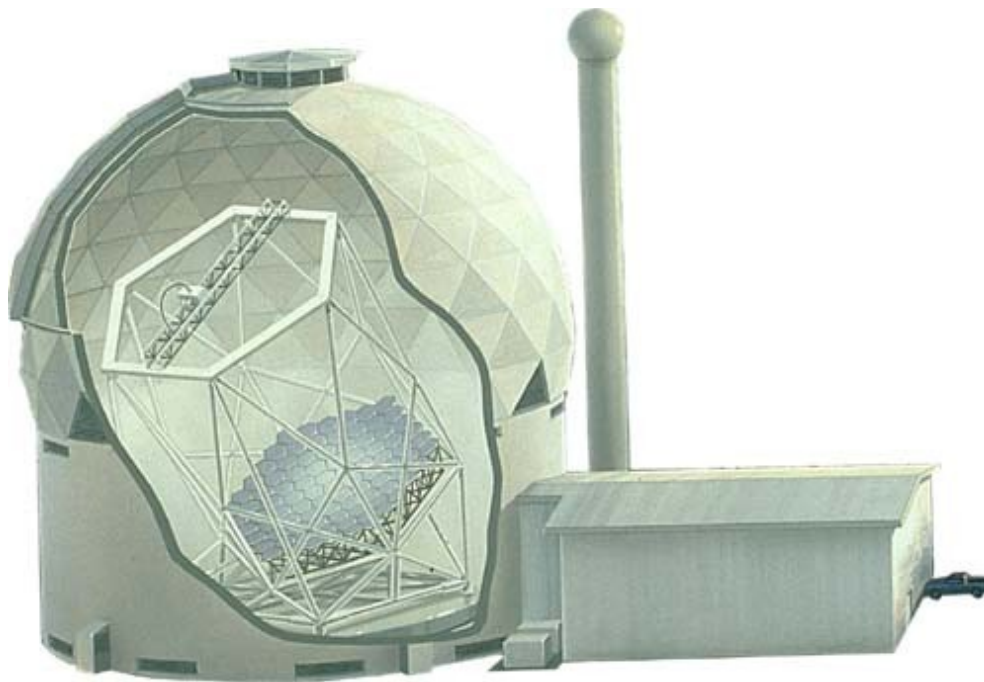
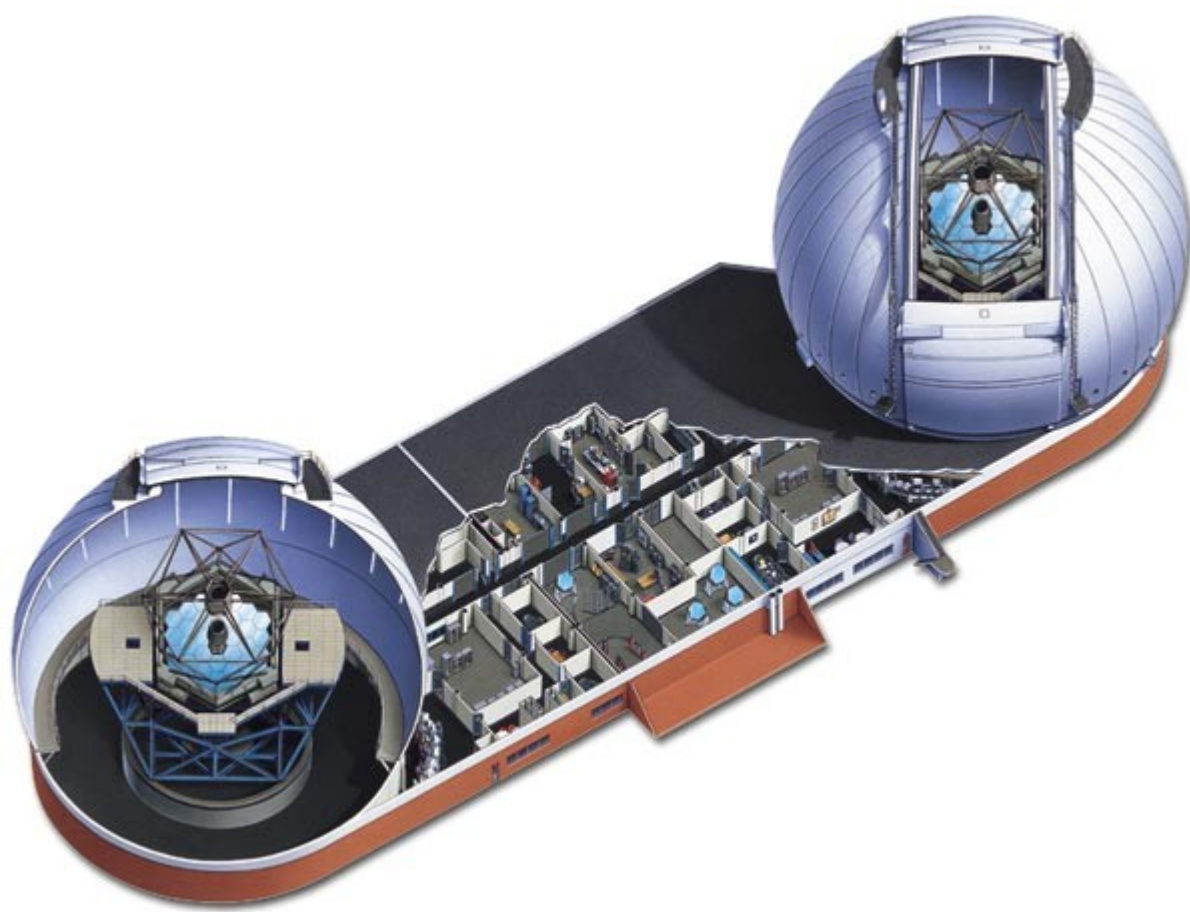
$$\textit{diffractionLimit} [\textit{''}] \approx 2.5 \times 10^5 \textit{ time} \left(\frac{\lambda}{\textit{telescopeDiameter}} \right)$$

Telescope Designs

- There are two basic types of telescopes
 - Refractors use a primary lens to focus light.
 - Reflectors have a primary mirror.



Big Telescopes



Ways We Use Telescopes

- Scientists don't ever physically look through telescopes.
 - Imaging – using CCDs
 - Photometry – Measure the brightness of objects very accurately.
 - Astrometry – measure the locations of objects very accurately.
 - Spectroscopy – break the light into a spectrum and measure that
 - Timing – measure changes over time.

Minute Essay

- Do you have any questions about telescopes?
- The second midterm is next week on Wednesday.
- Have a good fall break.