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.

\[ \text{angularSeparation} = \text{physicalSeparation} \times \frac{360^\circ}{2\pi \times \text{distance}} \]

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

\[ \text{angularSeparation} = 206,265'' \times \frac{\text{physicalSeparation}}{\text{distance}} \]
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.

\[ \text{diffractionLimit} [\prime\prime] \approx 2.5 \times 10^5 \text{time} \left( \frac{\lambda}{\text{telescopeDiameter}} \right) \]
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.