An introduction to

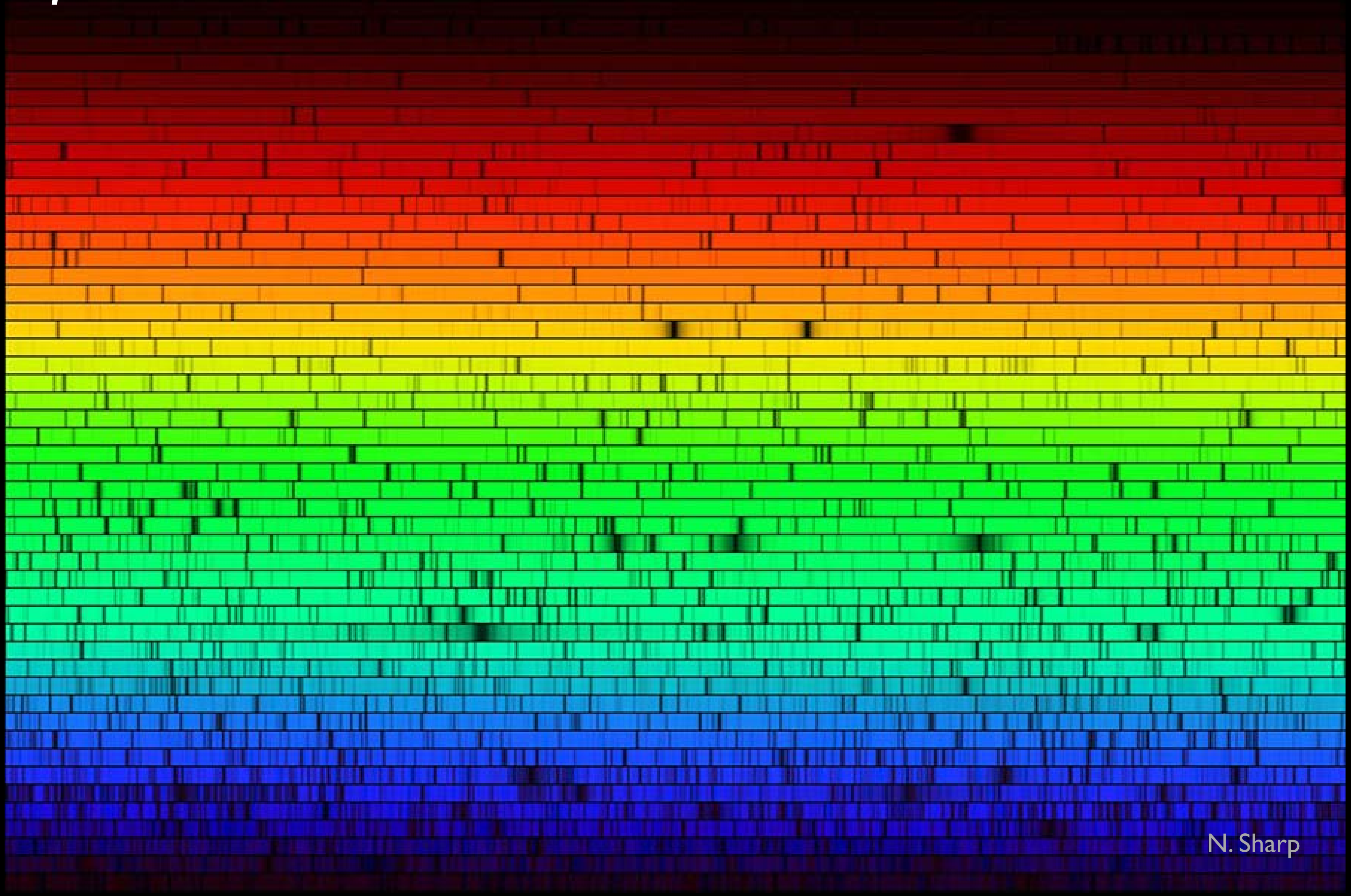
Starlight

Zach Meisel

Ohio University - ASTR1000

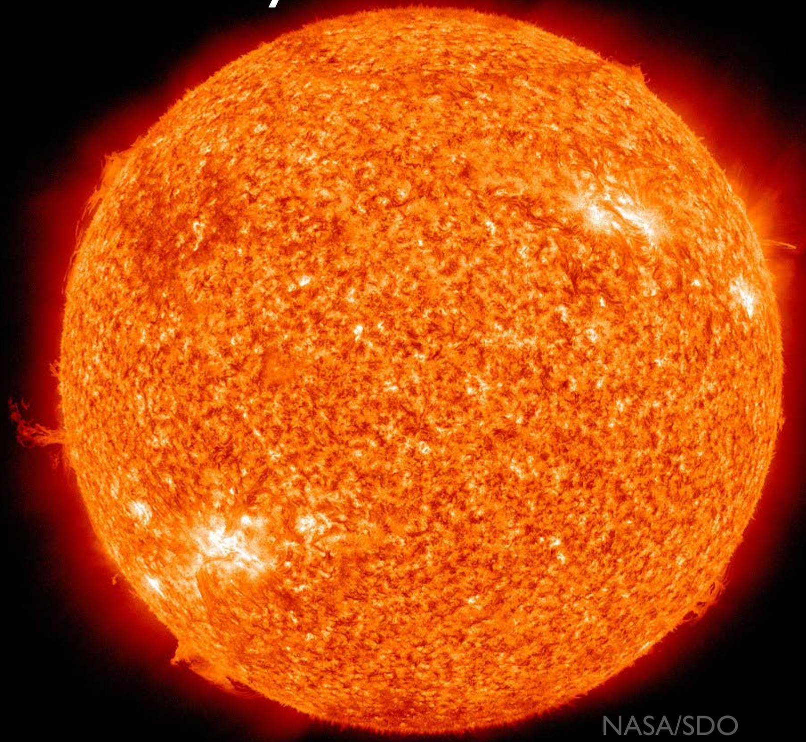
Direct information from starlight

Spectra



N. Sharp

Luminosity



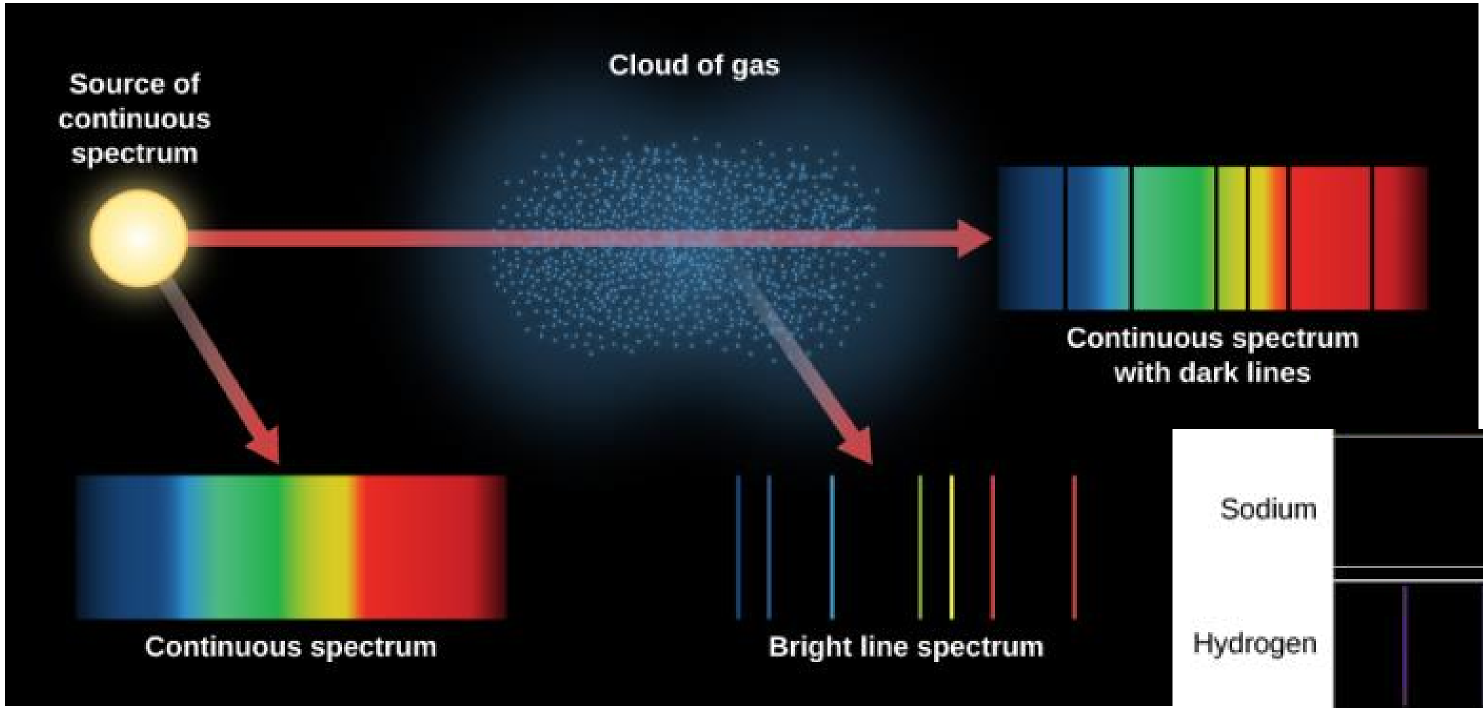
NASA/SDO

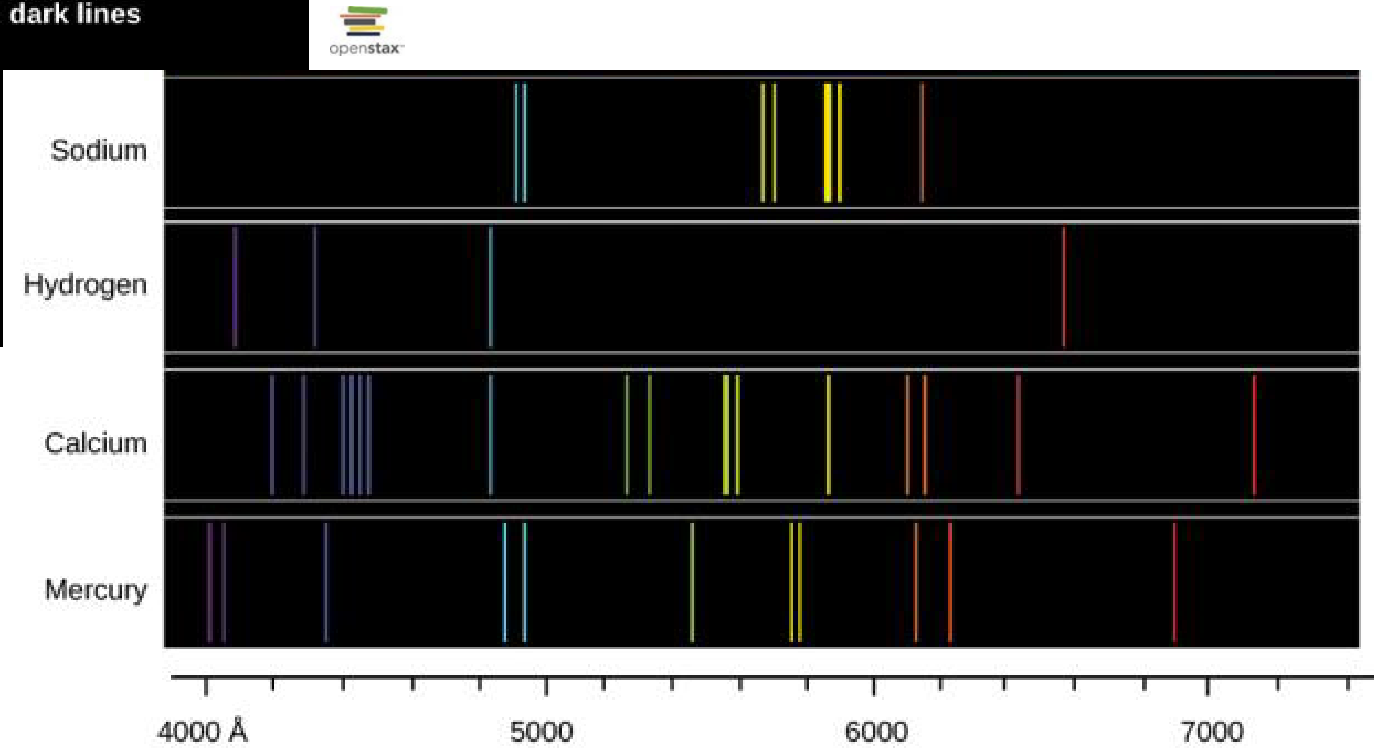
Color

GiovanniMartin16

Stellar spectra

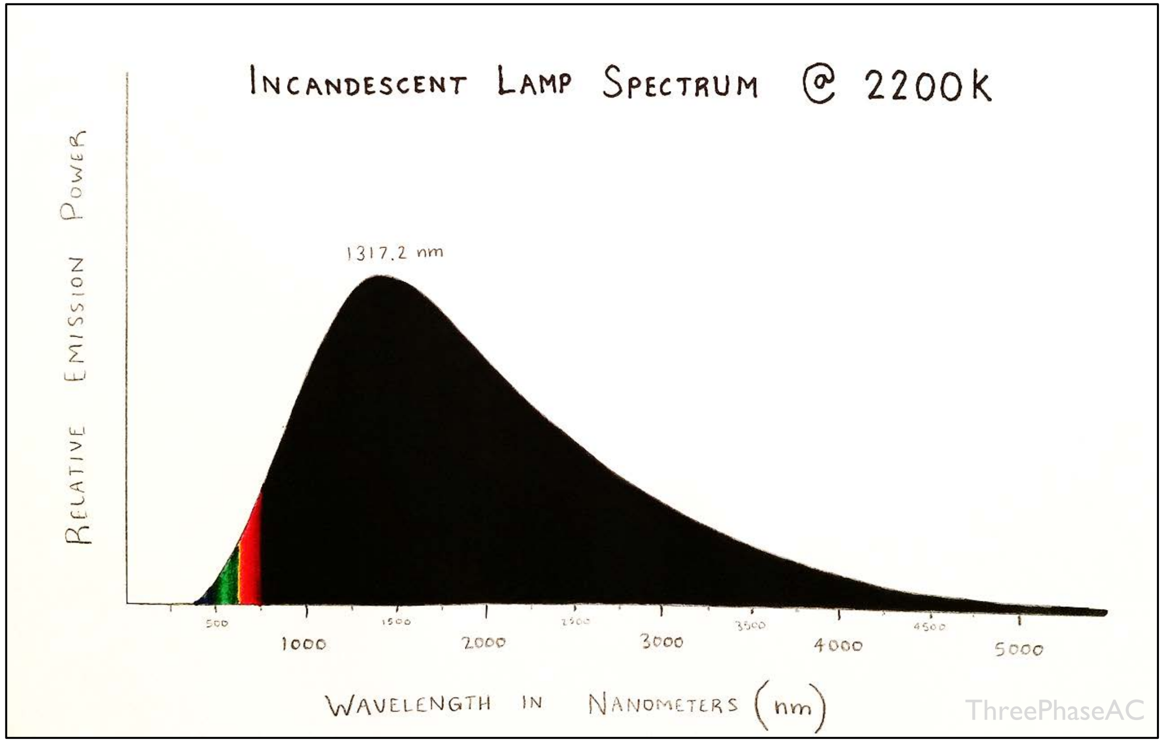
- …will be covered more in "Introduction to Stellar Spectra"
- Recall from "Introduction to Spectra":

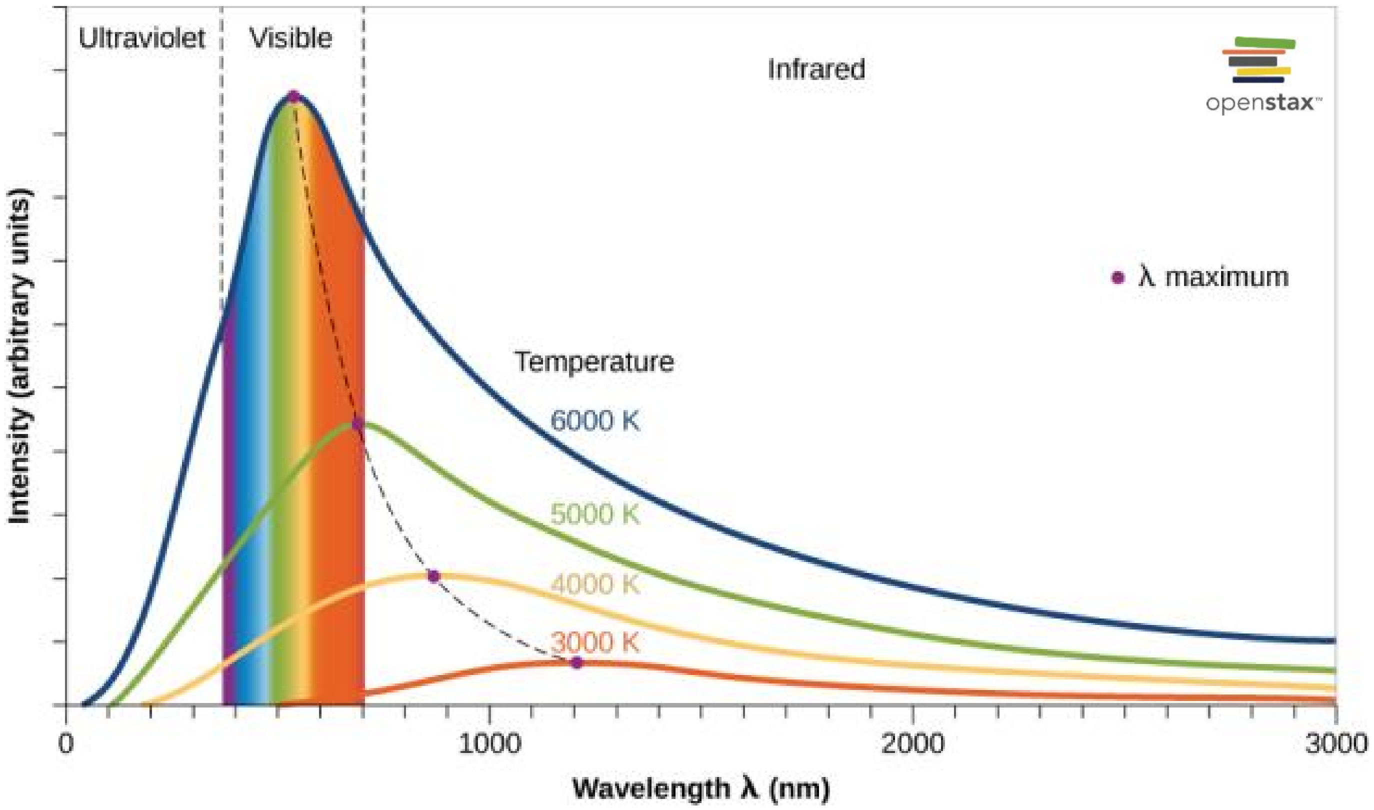




Stellar color

- Recall from "Introduction to Light":
  - $\lambda_{\max} = \frac{2.9 \times 10^6 \, nm}{T \, [K]}$, where $T \, [K]$





- An incandescent bulb has $\lambda_{\max} \sim 1300 \, nm$
  So, $T_{\text{bulb}} \approx (2.9 \times 10^6 \, nm)/(1300 \, nm) = 2200 \, K$~3500 F

Ways to say how much light a star emits:

- **Luminosity**: Actual amount of energy emitted in light from the star. Technically if we're considering all wavelengths, we mean **bolometric luminosity**
- **Apparent magnitude**: How bright a star is when observed from Earth in a given band of wavelength
- **Absolute magnitude**: How bright a star would appear from Earth if it were located 10 parsecs away using a given band of wavelength

Why use these separate descriptions?

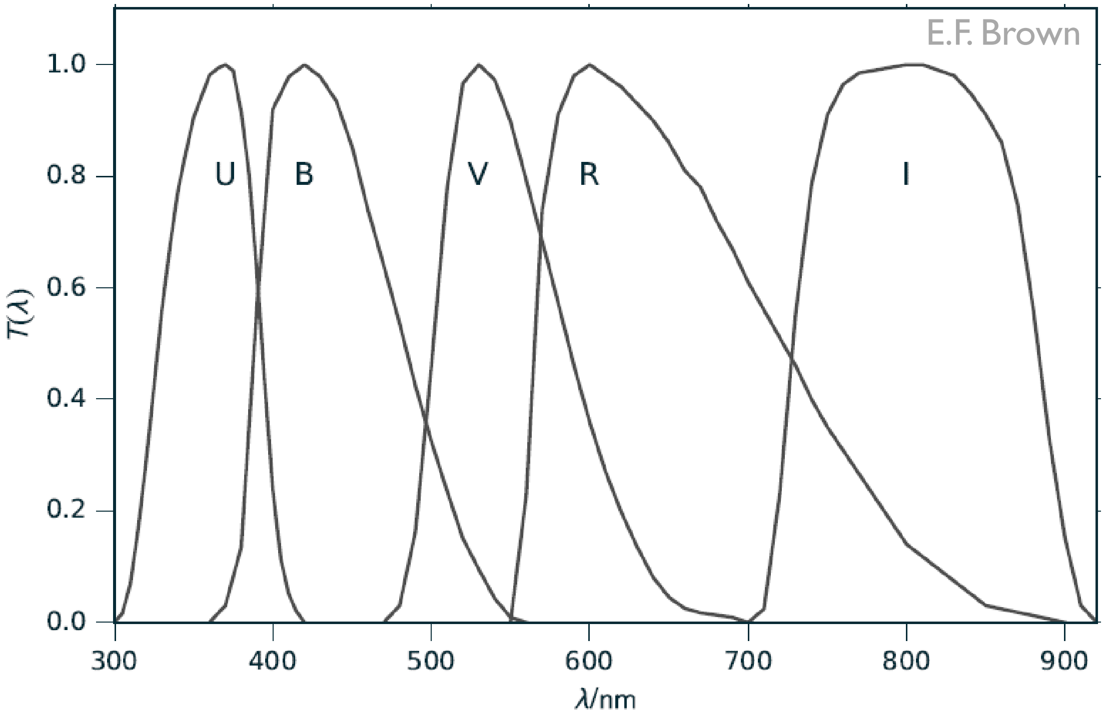
Luminosity is an intrinsic property, related to stellar structure.

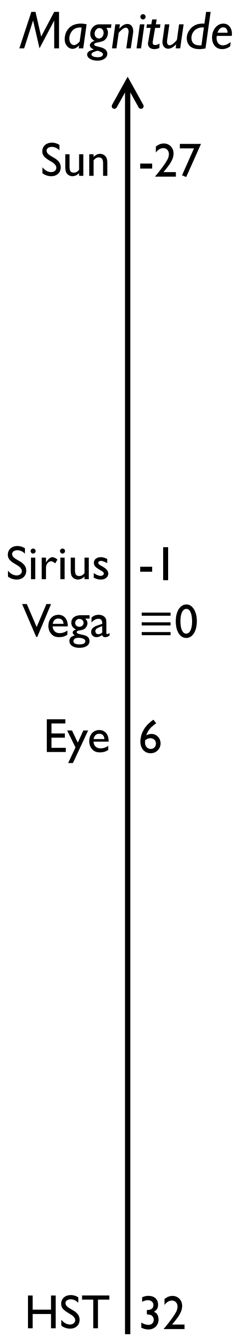
Apparent magnitude is something you can actually measure.

Absolute magnitude lets us use the concept of magnitude, but relaying information about the luminosity (in a wavelength range).

Apparent Magnitude:

- Apparent magnitude, m, is relative. For stars A and B,
  - $m_A - m_B = -2.5\log\left[\frac{F_A}{F_B}\right]$ *could also use brightness ratio*
- The fluxes are typically measured in a particular λ-range, known as a band. Often the letter for the band will be used in place of m
- The difference between m in two different bands provides rough spectral information.
  i.e. we can infer the surface temperature





Absolute Magnitude

- Absolute magnitude M corrects m (in a given λ-band) for distance.
- It is what m would be if the distance to the star were 10 parsecs (10 pc = 32.6 ly)
- Distance modulus: $DM = m - M = 5\log(d) - 5$ (with d in pc)