- **Astronomical Measurements**

  - Flux & Luminosity: $F = \frac{L}{4\pi d^2}$

  - Magnitudes: $m1 - m2 = 2.5 \log\left(\frac{f1}{f2}\right)$

  - Small angle formula: $\theta = \frac{d}{l}$ for θ in radians, d and l in the same Units.
    - Parallax: $d = \frac{1}{p}$ for p in $''$, d in pc.

  - Absolute Magnitude: M is m measured at 10pc

  - Colors, $B - V$, $B - R$, etc., related to temperature

  - Distance Modulus: $m - M = 5 \log\left(\frac{d}{10\,\mathrm{pc}}\right)$

  - Surface brightness

    - Concept: *not* "brightness at the surface"
    - Distance independence
    - $\frac{L_\odot}{\mathrm{pc}^2} \Longleftrightarrow \frac{\mathrm{mag}}{\mathrm{arcsec}^2}$

  - Spectroscopy: F_λ

- **Stars**

  - OBAFGKM

  - Evolution: main sequence (Hydrogen burning), Red Giant (Hydrogen shell burning), Helium flash (maybe!), Horizontal Branch or Red Clump (Hydrogen/Helium burning), Asymptotic Giant Branch (Carbon/Helium/Hydrogen burning).

  - Endpoints: white dwarf for low mass stars, supernovae for high mass stars

  - Lifetime: shorter for stars of higher mass

  - H-R diagram

  - Open and Globular Clusters

- **Galaxy Classification**

  - The Hubble Tuning Fork Diagram

  - Spirals, Ellipticals, dwarf Irregulars, dwarf Spheroidal

  - Sequence of spirals: Sa-Sb-Sc-Sd
    - Increasing gas fraction, color increasingly blue, Decreasing metallicity, (roughly) decreasing luminosity, decreasing bulge size, increasingly open spiral arms

  - Surface photometry, isophotal contours (e.g. "boxy" vs. "disky" elliptical galaxies)

- **Chemical Evolution**

  - "Metallicity"– fractional heavy element abundance.

  - Definition of [Fe/H] and Z. ($Z_\odot \sim 0.02$)

  - Metallicity & the cycle of star formation and death; heavy element enrichment.

  - What correlates with it.