

Astronomy 185 — Introduction to Astrophysics

- ▶ Today's class — introduction
 - syllabus
 - overview of course material
 - properties of stars
- ▶ Reading assignment: Carrol & Ostlie — Chapter 3

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- ▶ General questions in stellar astrophysics:
 - ⇒ What are the properties of stars, what determines them?
 - ⇒ What are the compositions of stars?
 - ⇒ What is the energy source that powers a star?
 - ⇒ How do stars form?
 - ⇒ How do stars die?

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- ▶ We are also interested in how to answer these questions:
 - ⇒ What kinds of observations are possible?
 - ⇒ What does each reveal about stars?
 - ⇒ How are these pieces put together into a big picture?
- ▶ Begin by considering properties of stars.

Astrophysical Basics

- ▶ Flux:
 - amount of radiant energy crossing a unit area per second.
 - may be specified per unit wavelength or frequency.
- ▶ Apparent magnitude:
 - brightness of a star as it appears when observed from the Earth.
- ▶ Absolute magnitude:
 - brightness of a star when observed from a distance of 10 parsecs
- ▶ Bolometric magnitude:
 - absolute magnitude over entire spectrum.
- ▶ Distance modulus:
 - difference between apparent and absolute magnitudes.

Astrophysical Basics

- ▶ extinction:
 - change in brightness due to light scattered or absorbed by intervening material
- ▶ reddening:
 - change in color caused by intervening material.
 - wavelength dependent extinction curve.
- ▶ Parallax:
 - shift in position caused by change in perspective.
- ▶ Proper motion:
 - shift in position caused by physical motion of a star.
 - transverse motion, i.e. across line of sight.
- ▶ Radial velocity:
 - speed along the line of sight.

Astrophysical Basics

- ▶ Spectral type:
 - stellar classification based on absorption line strengths.
- ▶ Color index:
 - difference in magnitude between different bandpasses.
 - blue bandpass - red bandpass by convention.
- ▶ Effective temperature:
 - temperature of a blackbody which produces same bolometric luminosity as a star.
- ▶ Luminosity class:
 - classification based on luminosity relative to main sequence.
- ▶ Hertzsprung-Russell diagram:
 - plot of color, temperature or spectral type vs. absolute or apparent magnitude.

- ▶ Milky Way is an average spiral galaxy:
 - Constituents:
 - Disk shape 30,000 pc diameter \sim 1000 pc thick.
 - Central region — bulge or spheroid.
 - nucleus: massive black hole ($M_{\bullet} \sim 3.0 \times 10^6 M_{\odot}$)
 - outer halo: spherical shape.
- ▶ Sun is 8.5 kpc from Milky Way center.
- ▶ Mass of the Milky Way — a few $\times 10^{11} M_{\odot}$,
- ▶ Nearest large galaxy is Andromeda galaxy.

- ▶ Star-formation triggered in dense molecular cloud.
- ▶ Factors which influence protostar collapse:
 - self-gravity: collapse initiates in over-dense region.
 - turbulence: relative motion of material within cloud opposes collapse.
 - magnetic field: field lines threaded through ISM oppose collapse.
 - composition: alters cooling and local density.