



Wednesday, Feb 14, 2018

Pick up: Notes

Today you will:

- Notes on Stars

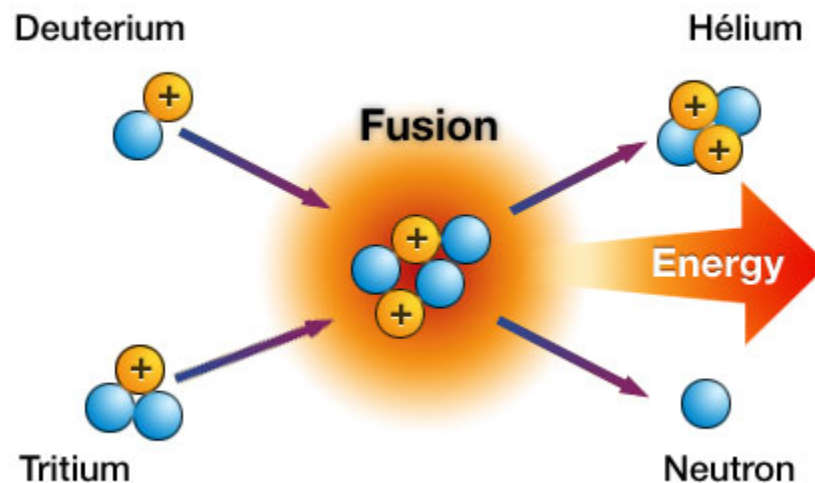
HOMEWORK:

Study what we've done so far

Properties of Stars:

What is a star?

- A star is a large ball of gas that gives off a tremendous amount of *electromagnetic energy* by the process of nuclear fusion in its core.
- Nuclear fusion -Hydrogen atoms fusing to form Helium

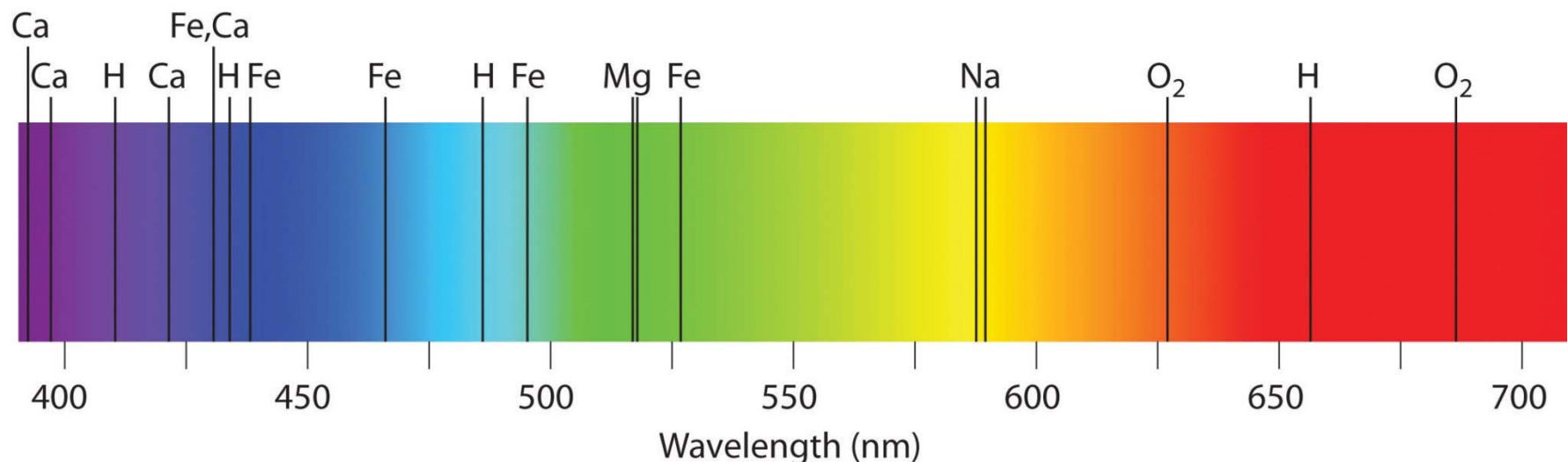


Properties of stars: Distances to Stars

- Distance to other stars is measured in Light years.
- Light year – The distance light travels in one year (9.46 trillion km)
- The sun is 8 light minutes from Earth.
- Nearest star to Earth is Proxima Centauri (4.2 light years away).

Properties of stars: Analyzing Starlight

- Astronomers determine the composition and temperature of a star by analyzing the light that a star emits.
- Spectrographs separate light into different colors or wavelengths.



Analyzing Starlight

- Bands of color crossed by dark lines (dark-line spectra) tell what the star is made of and its temperature.
- Different elements absorb different wavelengths of light.

Element	Typical Star
Hydrogen	Most stars
Helium	Most stars
Calcium	Most stars
Sodium	Most stars
Iron	Most stars

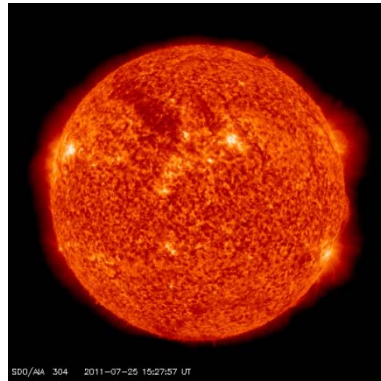
Properties of Stars:
Composition of Stars

- Every element has a different spectrum.
- Most stars are made up of Hydrogen and helium.

Properties of Stars: Temperatures of Stars

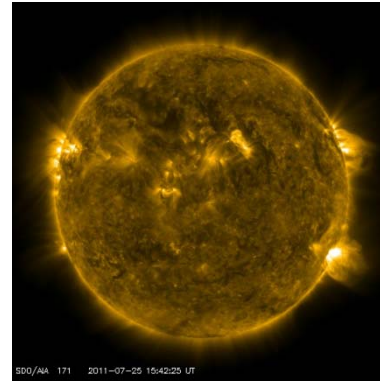
- Red –
Coolest
- White –
Medium
- Blue –
Hottest

Red star



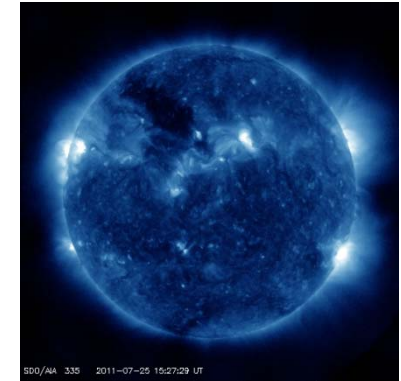
3,000 K

Yellow/white star



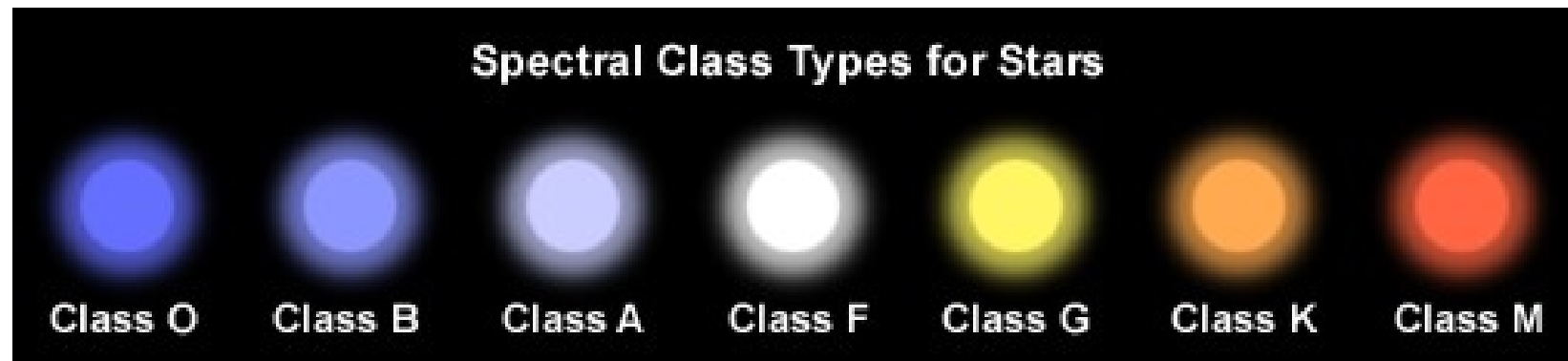
5,000 K

Blue star



10,000 K

- A stars surface temperature can be estimated based on its color.



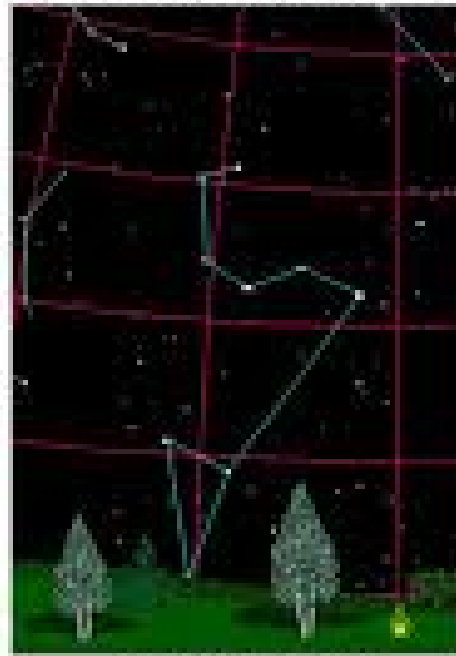
Stellar Motion

- Apparent motion – motion as it appears from Earth, caused by the movement of Earth.
 - 1. As Earth rotates, the stars appear to move across the sky.
 - 2. On Earth, stars appear in a different place in the sky than they were the night before. This is caused by Earth revolving around the sun.

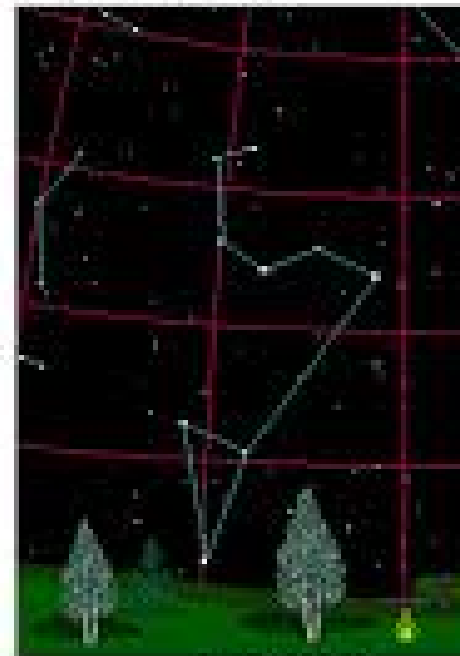
Leo moves through local grid in 48 hr increments



Day One
8:00pm



Day Three
8:00pm



Day Five
8:00pm

STELLAR MOTION

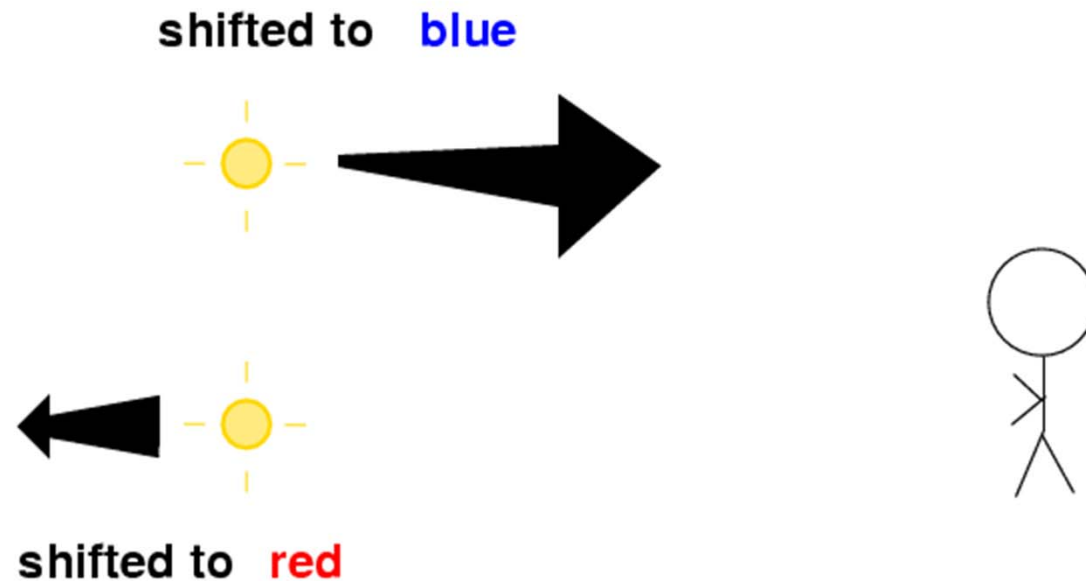
Stellar Motion

- Actual Motion – stars can move away from us, toward us, or may revolve around another star (a binary star is a pair of stars held together by gravity).



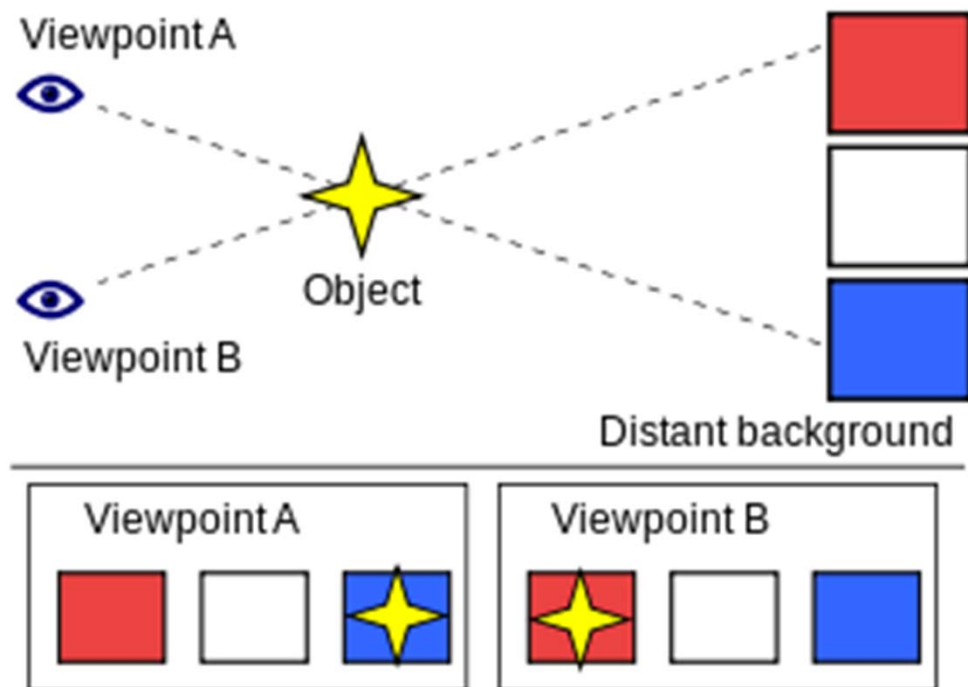
Doppler Effect (Doppler Shift)

- The apparent shift in the wavelength of light emitted by a source moving toward or away from an observer.
- Colors moving toward Earth are blue-shifted.
- Colors moving away from Earth are red shifted.



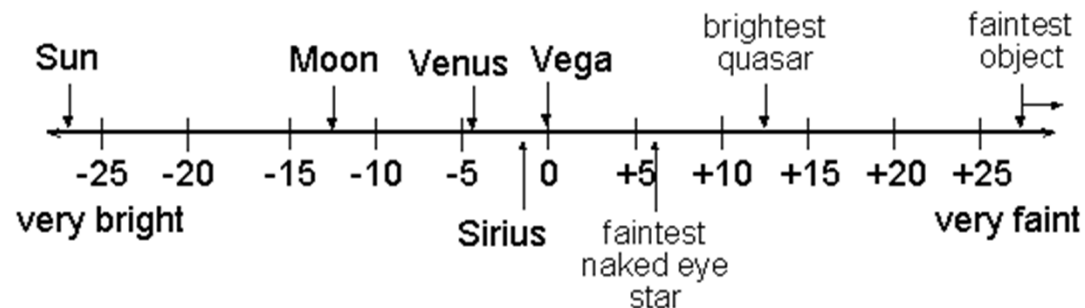
Determining Distance

- For close stars, scientists use parallax to determine distance from Earth. This works within 1,000 light-years from Earth.



Properties of star: Stellar Brightness

- Apparent magnitude – How bright a star appears from Earth.
 - This depends on how much light the star emits and how far the star is from Earth.
 - The lower the number on the scale, the brighter the star appears to Earthlings.



Apparent brightnesses of some objects in the magnitude system.

Properties of stars: Stellar Brightness

- Absolute magnitude – The true brightness of a star. (luminosity)
 - Absolute brightness is how bright a star actually is, the lower the number of its absolute magnitude.

Apparent and Absolute Magnitude

An Analogy:



A



B

Cars A and B are identical. A's headlights appear brighter because it is closer.



A



B

Cars A and B are at the same distance. A's headlights appear brighter because they are intrinsically brighter.

An Example:



Observer sees

An observer sees two stars. Star A appears brighter than Star B because it is closer to her.

Absolute magnitude is the brightness a star would have at a distance of 10 parsecs. If stars A and B were both 10 parsecs away from the observer, Star B would appear brighter than star A.

Section 2: Classifying Stars

- Astronomers graph temperature and luminosity of stars on the Hertzsprung-Russell diagram (H-R).
 - Highest temperatures are on the left and highest luminosities are at the top. Most stars fall diagonally through the middle. These stars are called main-sequence stars.

Hertzsprung-Russell Diagram

Luminosity, L (L_{Sun})

10^6

10^4

10^2

1

10^{-2}

10^{-4}

Supergiants

Giants

Main Sequence

White Dwarfs

40 000

20 000

10 000

5000

2500

Temperature T_K

