

Chapter

Properties of Stars

25.1

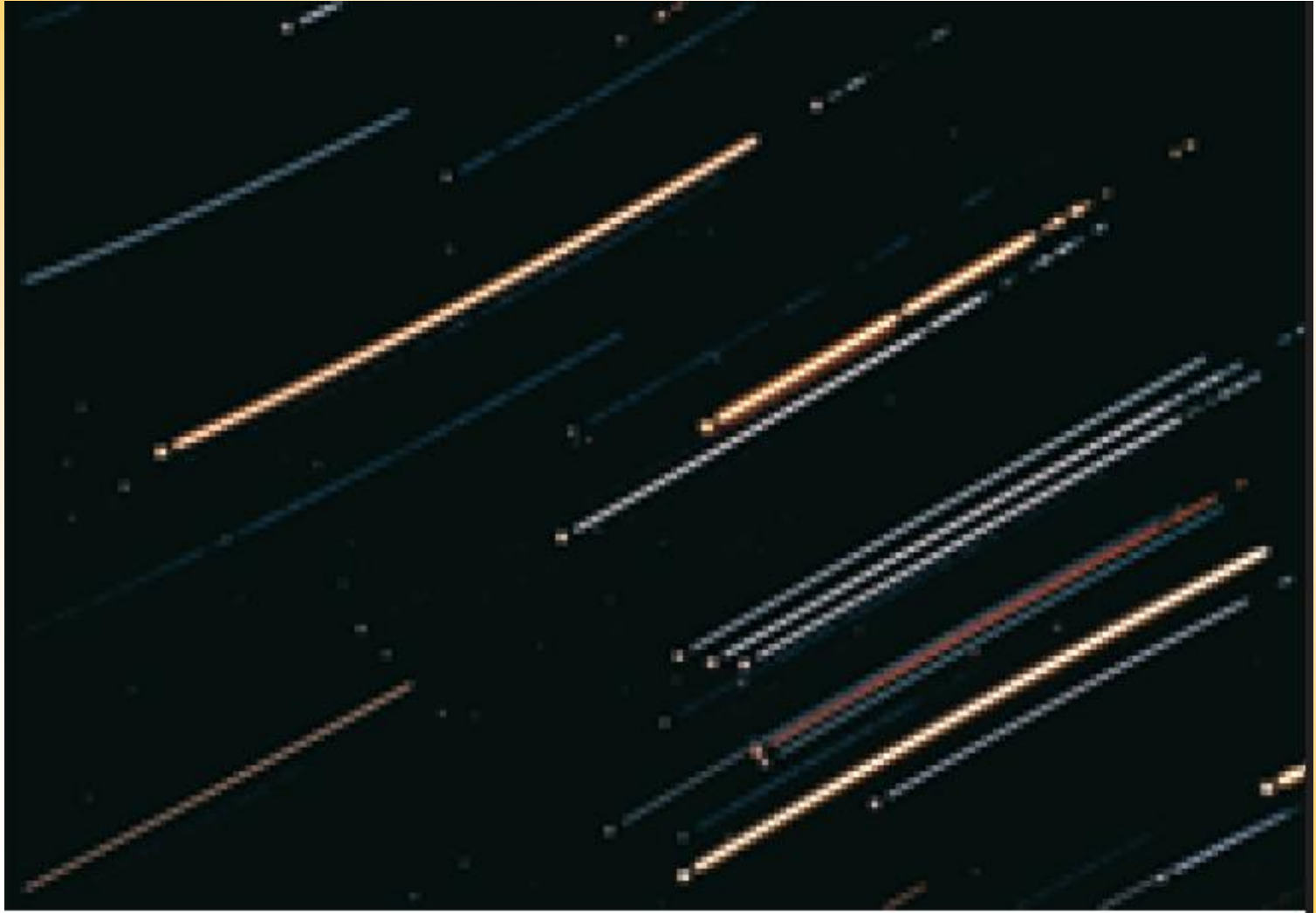
Be able to...

Describe what astronomers can learn by studying star properties.

List the factors that determine a star's apparent magnitude.

Describe the H-R Diagram and identify stars using the diagram.

What do you notice about the stars?



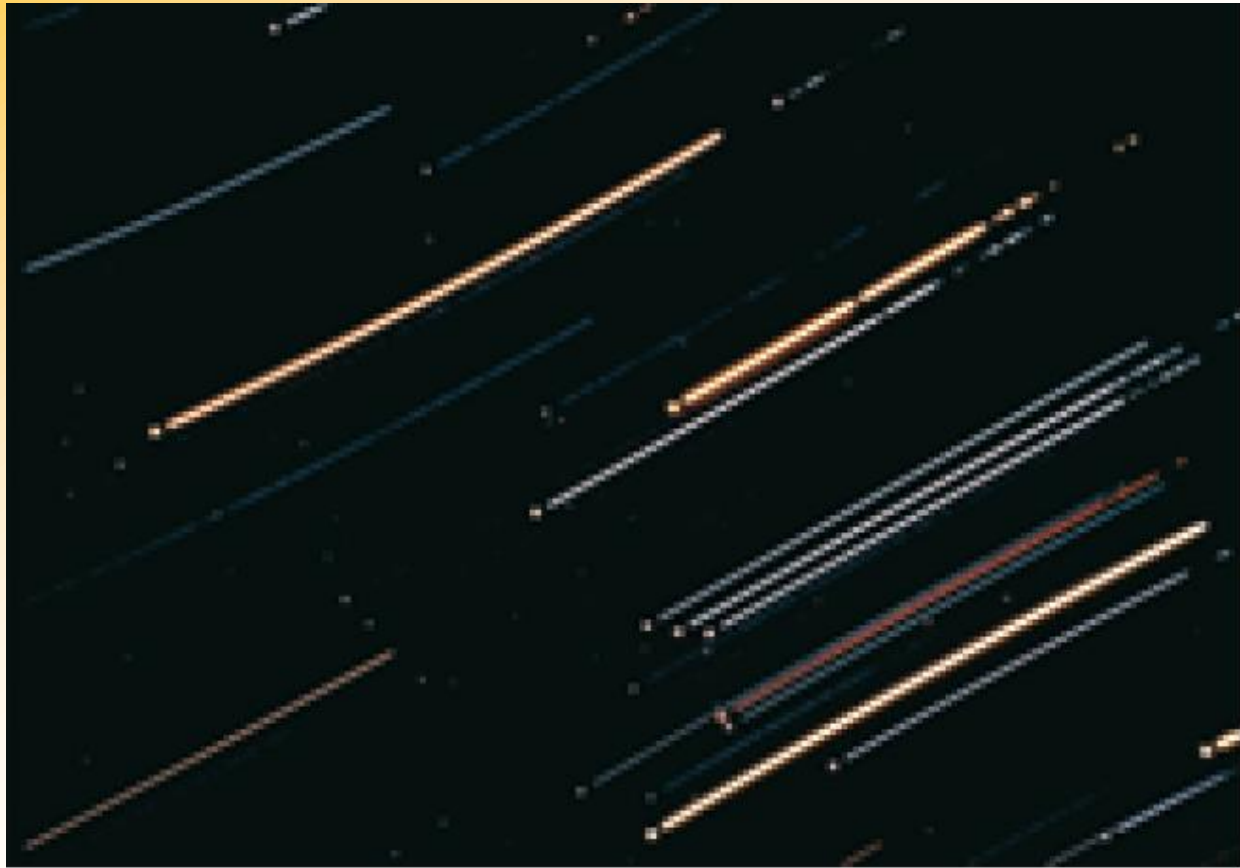


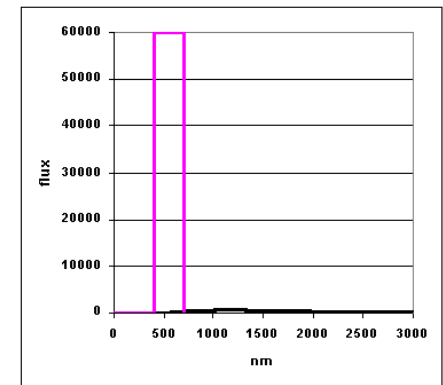
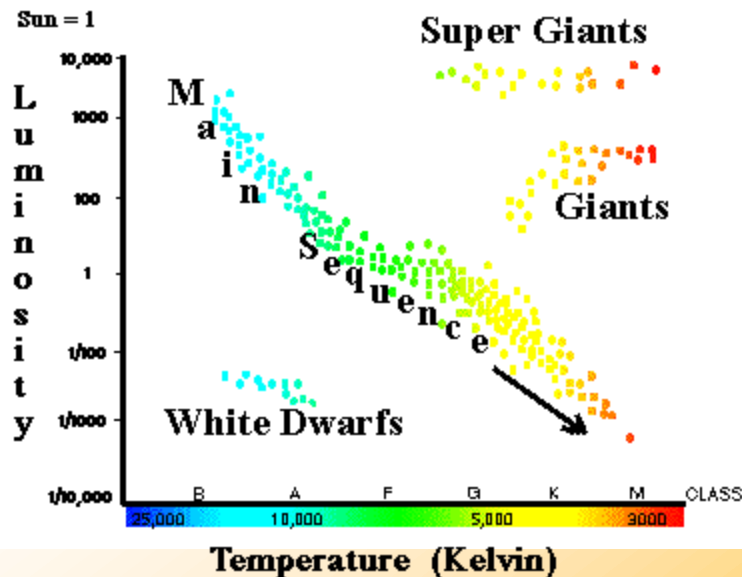
Figure 2 Stars of Orion This time-lapse photograph shows stars as streaks across the night sky as Earth rotates. The streaks clearly show different star colors.

Characteristics of Stars

1) Identify the relationship between temperature and color.

◆ Star Color and Temperature

- Color is a clue to a star's temperature.
 - *Blue is very hot (30,000 K)*
 - *Red is cool (5,000 K)*



Characteristics of Stars

2) What are binary stars?

- **Binary Stars and Stellar Mass**
- *Prefix bi - two*
- A binary star is one of two stars revolving around a common center of mass under their mutual gravitational attraction.
 - *More than 50% of the stars in the universe may occur in pairs of multiples.*



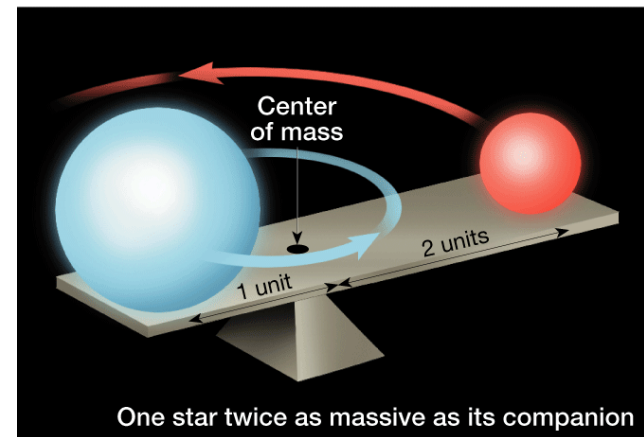
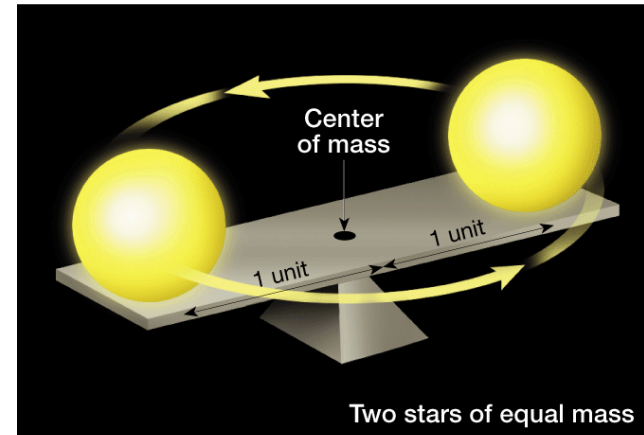
Characteristics of Stars

2) Why are binary stars important?

- Binary stars are used to determine the star property most difficult to calculate—its mass.
 - *More than 50% of the stars in the universe may occur in pairs of multiples.*

Figure 3 Common Center of Mass

A For stars of equal mass, the center of mass lies in the middle. **B** A star twice as massive as its partner is twice as close to the center of mass. It therefore has a smaller orbit than its less massive partner.

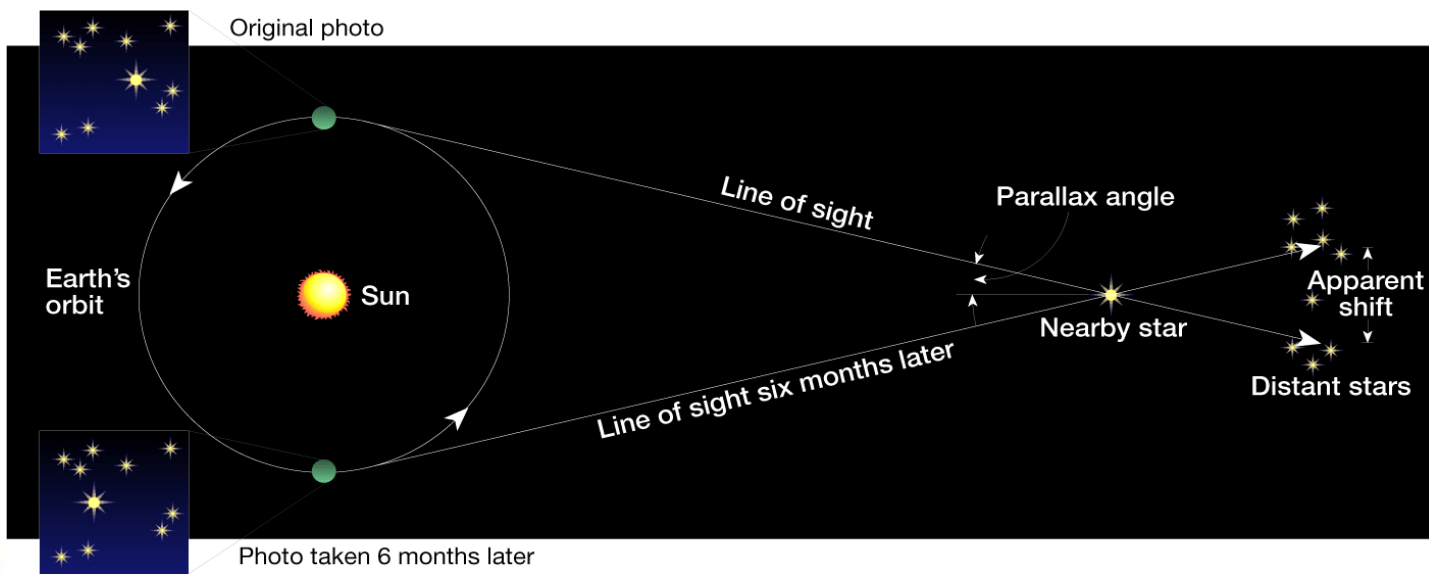


Ch 9 Measuring Distances to Stars

3) Explain how distance affects parallax.

◆ Parallax

- Parallax is the slight shifting of the apparent position of a star due to the orbital motion of Earth.
- The nearest stars have the largest parallax angles, while those of distant stars are too small to measure.
 - *Only a few thousand of the nearest stars are known.*



Measuring Distances to Stars

4) Identify a light year.

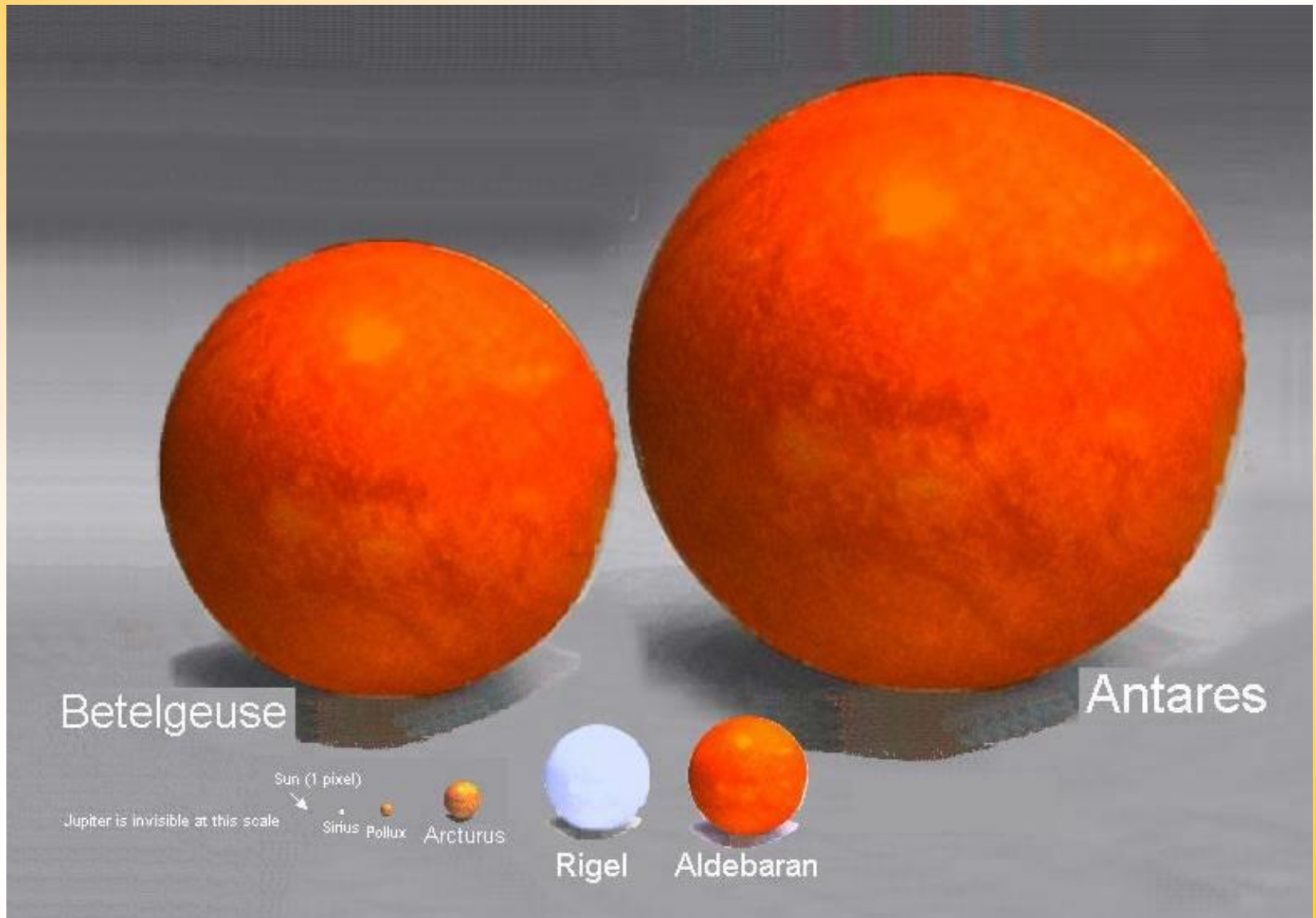
- **A light-year is the distance light travels in a year, about 9.5 trillion kilometers.**
 - *Distance to stars is so great that a light year unit is the best to express it.*
 - *Next closest star is Proxima Centauri ~ 4.3 light years away.*
 - *Light moves at a velocity of about 300,000 kilometers (km) each second*

Stellar Brightness

- ◆ **Apparent Magnitude vs. Absolute Magnitude**
 - **Apparent magnitude** is the brightness of a star when viewed from Earth.
 - Three factors control the apparent brightness of a star as seen from Earth:



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Stellar Brightness

◆ Apparent Magnitude

- **Apparent magnitude** is the brightness of a star when viewed from Earth.
- Three factors control the apparent brightness of a star as seen from Earth:
 1. how big it is
 2. how hot it is
 3. how far away it is

Stellar Brightness

◆ Absolute Magnitude

- **Absolute magnitude** is the apparent brightness of a star if it were viewed from a distance of 32.6 light-years.
- *How bright the star actually is.*

Distance, Apparent Magnitude, and Absolute Magnitude of Some Stars

Table 1 Distance, Apparent Magnitude, and Absolute Magnitude of Some Stars

Name	Distance (light-years)	Apparent Magnitude*	Absolute Magnitude*
Sun	NA	-26.7	5.0
Alpha Centauri	4.27	0.0	4.4
Sirius	8.70	-1.4	1.5
Arcturus	36	-0.1	-0.3
Betelgeuse	520	0.8	-5.5
Deneb	1600	1.3	-6.9

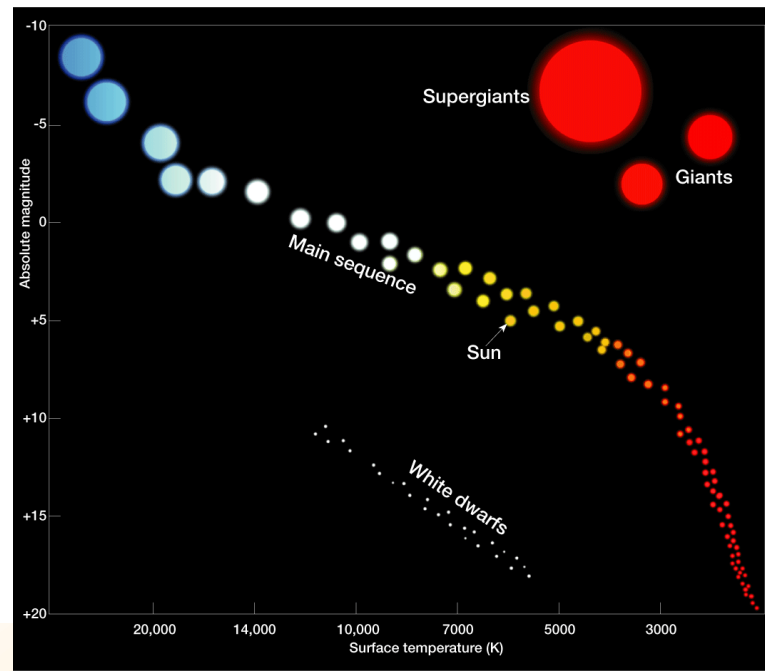
*The more negative, the brighter; the more positive, the dimmer.

Properties of Stars

Describe the relationship shown on a H-R diagram.

Hertzsprung–Russell Diagram

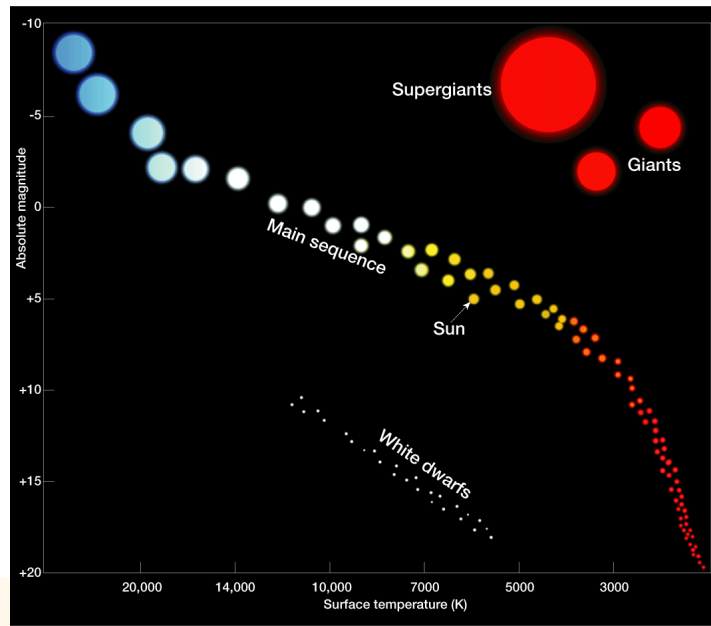
- ◆ A H-R diagram shows the relationship between the absolute magnitude and temperature of stars.



Properties of Stars

Hertzsprung–Russell Diagram

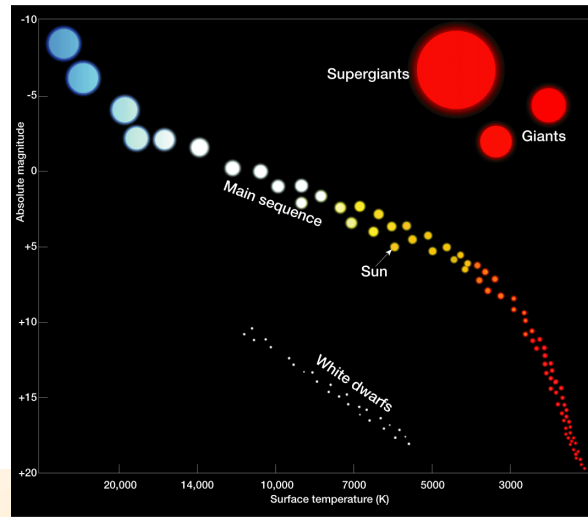
- ◆ A **main-sequence star** contains the majority of stars (90%) and runs diagonally from the upper left to the lower right on the H–R diagram.



Properties of Stars

Hertzsprung–Russell Diagram

- ◆ A **red giant** is a large, cool star of high luminosity; it occupies the upper-right portion of the H–R diagram.
- ◆ A **supergiant** is a very large, very bright red giant star.



Properties of Stars

Hertzsprung–Russell Diagram

◆ Variable Stars

- A **Cepheid variable** is a star whose brightness varies periodically because it expands and contracts; it is a type of pulsating star.
- A **nova** is a star that explosively increases in brightness.

Figure 6 Nova These photographs, taken two months apart, show the decrease in brightness that follows a nova flare-up.



Properties of Stars

Characteristics of Stars

- ◆ A **constellation** is an apparent group of stars that appear to form a shape in the night sky.
- ◆ Named for mythical characters.
- ◆ The sky contains 88 constellations.

Constellations

- The twelve constellations lying along the projection of the Earth's orbit onto the sky comprise the zodiac.

