

Stars, Galaxies, and the Universe ▪ *Section Summary*

Characteristics of Stars

Key Concepts

- How are stars classified?
- How do astronomers measure distances to the stars?
- What is an H-R diagram and how do astronomers use it?

When ancient observers around the world looked up at the night sky, they imagined that groups of stars formed pictures of people or animals. Today, we call these imaginary patterns of stars **constellations**.

Astronomers classify stars according to their physical characteristics. **Characteristics used to classify stars include color, temperature, size, composition, and brightness.** Stars vary in their chemical composition. Astronomers use spectrographs to determine the elements found in stars. A **spectrograph** is a device that breaks light into colors and produces an image of the resulting spectrum.

The brightness of a star depends upon both its size and its temperature. How bright a star looks from Earth depends on both its distance from Earth and how bright the star actually is. The brightness of a star can be described in two different ways: apparent brightness and absolute brightness. A star's **apparent brightness** is its brightness as seen from Earth. Astronomers can measure apparent brightness fairly easily using electronic devices. A star's **absolute brightness** is the brightness the star would have if it were at a standard distance from Earth.

Distances on Earth's surface are often measured in kilometers. However, distances to the stars are so large that kilometers are not very practical units. **Astronomers use a unit called the light-year to measure distances between the stars.** A **light-year** is the distance that light travels in one year, about 9.5 million million kilometers.

Standing on Earth looking up at the sky, it may seem as if there is no way to tell how far away the stars are. However, astronomers have found ways to measure those distances. **Astronomers often use parallax to measure distances to nearby stars.** **Parallax** is the apparent change in position of an object when you look at it from different places.

Two important characteristics of stars are temperature and absolute brightness. Ejnar Hertzsprung and Henry Norris-Russell made a graph to find out whether these characteristics are related. The graph they made is called the **Hertzsprung-Russell diagram**, or H-R diagram. **Astronomers use the H-R diagram to classify stars and to understand how stars change over time.** Most of the stars in the H-R diagram form a diagonal line called the **main sequence**. More than 90 percent of all stars, including the sun, are main-sequence stars. In the main sequence, surface temperature increases as brightness increases.