BIRTH, LIFE, AND DEATH OF STARS

Chapter 19-24

INTRODUCTION The evolution of a star is a complex series of events that can be easily simplified if analyzed in a series of steps. The systematic classification of stars made this analysis possible. At the turn of the 20th century, astronomers and technicians at the Harvard Observatory developed a classification system of stars based on the star's spectroscopic properties, known as the MMK system. Later analysis revealed that a better classification scheme used stellar surface temperature. Hertzsprung and Russell independently developed graphs which diagrammed the relationship of stellar classification (spectral or thermal) and stellar luminosity. This graph is now known as the Hertzsprung-Russell diagram. The very powerful H-R diagram can be used to estimate the distance to stars (using the inverse-square law of light) by inferring the star's luminosity from its classification. These chapters describe stellar evolution from nebula (emission or dark), to main sequence star, and finally to planetary nebula or supernova explosion. Introduced, as well, are some of the thermonuclear sequences which produce heavier elements. The final phase of stellar evolution discussed is the end of the star's life and the production of the stellar corpse – the white dwarf, neutron star (and possibly pulsar), or black hole.

GOALS

- ✓ It is important to know the evolutionary sequence of a star from nebula to corpse and the differences in the evolution which are attributable to the type of nebula from which the star evolves and the ultimate fates of a star which are determined by mass.
- ✓ Calculations of stellar mass in binary star systems are reviewed and applied in these chapters. You should be able to perform these kinds of calculations.
- ✓ Binary star systems are not uncommon. You should know the different kinds of binary systems and how they are identified. Likewise, bare black holes are difficult or maybe impossible to observe but they can be inferred from the effect they have when combined in a binary system.
- ✓ The H-R diagram is a vitally important tool for the astronomer. You must be able to use it to make predictions about a star's attributes and characteristics.
- ✓ It is important to be able to distinguish between the different stellar corpses in terms of their properties and composition.

DEFINITIONS

You should have a working knowledge of at least these terms and any others used in lecture and lab. Many of. these terms will be found In the glossary at the class website.

absolute magnitude
apparent magnitude
luminosity
spectral class
binary star
optical binary
visual binary
spectroscopic binary
eclipsing binary
main sequence
red giant
red supergiant
red dwarf
white dwarf
neutron star
black hole
parallax
accretion
cluster
dark nebula
emission nebula
dust
evolutionary track
H II region
H-R diagram
nebula
protostar
reflection nebula
supernova
supernova remnant
P-P chain
triple-alpha
CNO cycle
helium flash
carbon detonation
asymptotic giant branch
degenerate electron gas
degenerate neutron gas
pulsar
synchrotron radiation
schwarzschild radius