Chapter 23. Life Stories of Stars

Note. In this section we describe the evolution of several stars based on their mass.

Note. We will now consider the evolution of our favorite one solar mass star. As the Sun burns its H supply, the core shrinks and temperatures rise. When the H core is gone and replaced with He "ash," reactions start in a shell surrounding the core. The core continues to shrink and the outer layers expand producing a red giant. The core shrinks until it becomes *degenerate* (free electrons repel one another and prevent further collapse). Eventually, the core becomes hot enough for the *triple alpha reaction* to occur in which helium nuclei combine to form carbon. his reaction lasts only a few seconds and is called the *helium flash*. The star eventually exhausts the helium core and expands to become a red giant a second time. The outer layers will then expand away producing a *planetary nebula* leaving only the Sun's core as a *white dwarf* which evolves no more. One cubic centimeter of a white dwarf would weigh a ton.

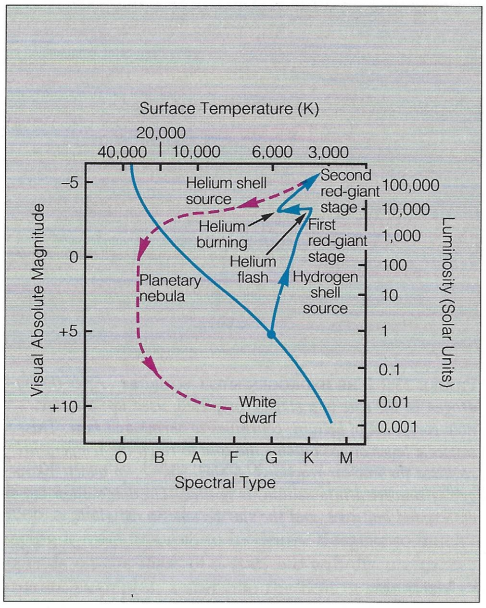

Figure 23.3. Evolutionary track of a star like the Sun.

Note. A 5 solar mass star burns its H core in about 100 million years. It then will undergo several spurts of nuclear activity in the core, becoming a red giant several times .

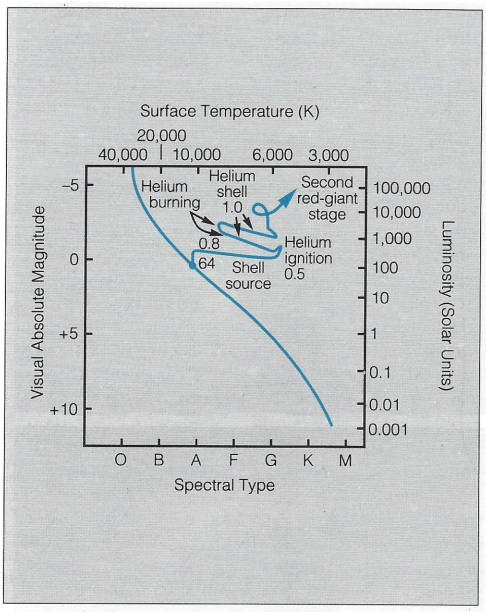

Figure 23.10. Evolutionary track of a five solar-mass star.

Note. More massive stars may burn their fuel, collapse, and explode as a *supernova*. Instead of a white dwarf, a *neutron star* forms; one cubic centimeter of a neutron star would weigh 1 billion tons.

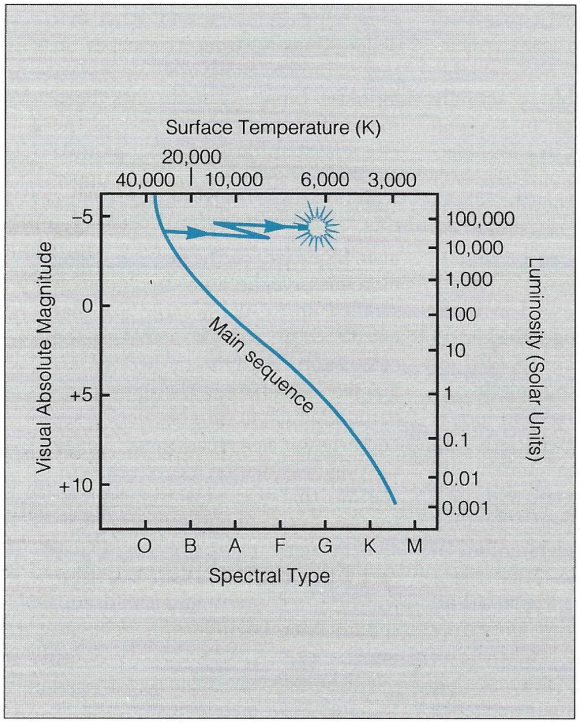

Figure 23.16. Evolutionary of an O star.

Note. A very massive star may produce an iron core, after which no reactions will occur and a collapse starts. It is possible that nothing can stop the collapse and a *black hole* is formed.

Note. In a binary system, stars may exchange material, affecting each others evolution.

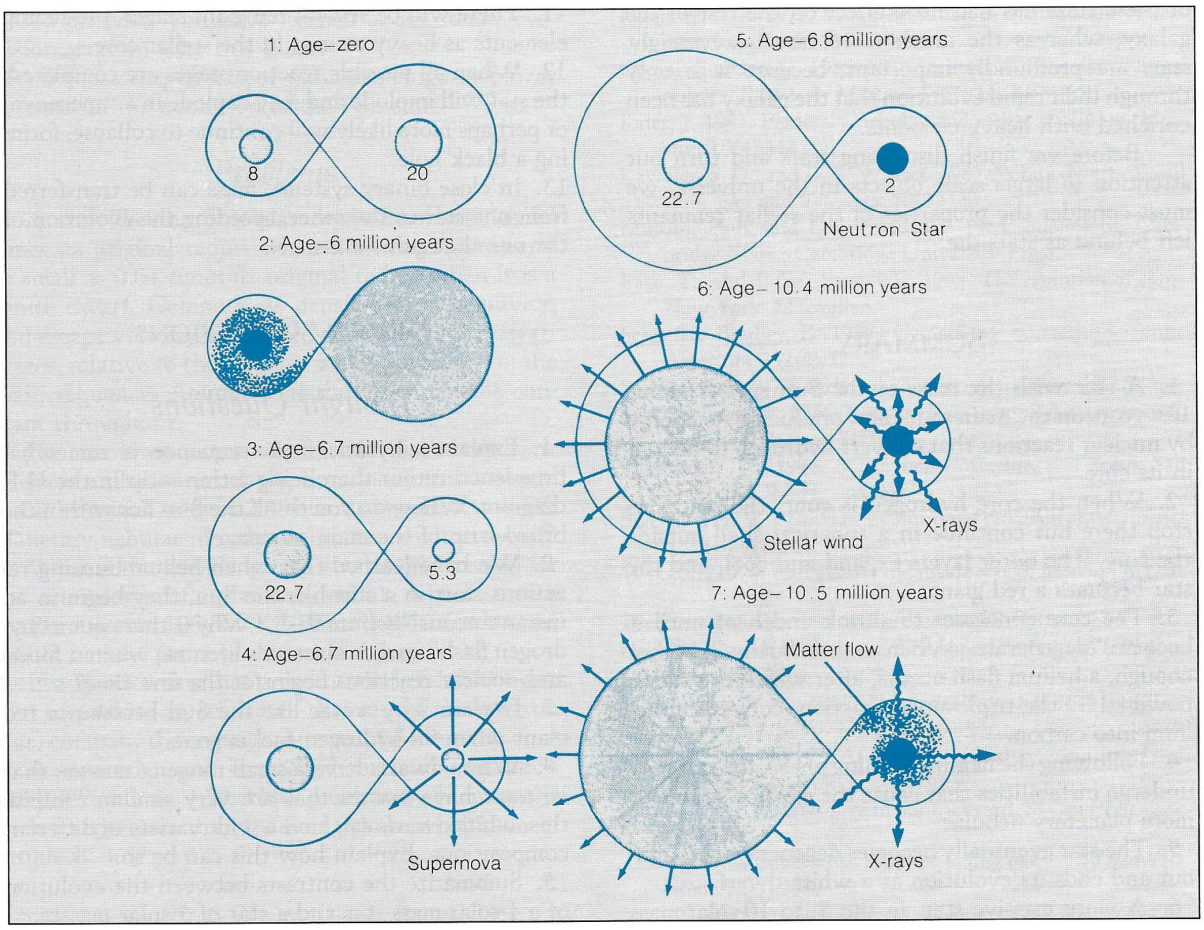

Figure 23.19. Mass exchange and evolution in a close binary system.

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