A star's ultimate fate depends on its mass. It can fade into obscurity (brown dwarf or red dwarf), become a white dwarf (sun-like stars), explode as a supernova and leave behind a neutron star or a black hole (massive to very massive stars), or be disrupted entirely (white dwarfs in close binary systems, or extremely massive stars).

END PHASES

The Milky Way galaxy contains several hundred billion stars of various ages, sizes and masses. A star forms when a dense cloud of gas collapses until nuclear reactions begin deep in the interior of the cloud and provide enough energy to halt the collapse.

Many factors influence the rate of evolution, the evolutionary path and the nature of the final remnant. By far the most important of these is the initial mass of the star. This handout illustrates in a general way how stars of different masses evolve and whether the final remnant will be a white dwarf, neutron star, or black hole.

Stellar evolution gets even more complicated when the star has a nearby companion. For example, excessive mass transfer from a companion star to a white dwarf may cause the white dwarf to explode as a Type Ia supernova.

The terms found in the boxes on the previous pages and in the Chandra images shown here can be matched to those in the main illustration. These give a few examples of stars at various evolutionary stages, and what Chandra has learned about them. X-ray data reveal extreme or violent conditions where gas has been heated to very high temperatures or particles have been accelerated to extremely high energies. These conditions can exist near collapsed objects such as white dwarfs, neutron stars, and black holes; in giant bubbles of hot gas produced by supernovas; in stellar winds; or in the hot, rarified outer layers, or coronas, of normal stars.

For more information, go to:
http://chandra.si.edu/xray_sources/
Large cold clouds of dust and gas where stars form.

A star with a mass approximately 8% and 50% of the mass of the Sun.

A phase in the evolution of a star just before nuclear reactions ignite.

A star with a mass between about 50% and 10 times that of the Sun.

An object with a mass less than about 8% of the mass of the Sun, but about 10 times greater than that of Jupiter.

A star with a mass approximately 5% and 50% of the mass of the Sun.

A star that has consumed all the hydrogen in its core, and energy generated by nuclear reactions is now generated in the shell. It becomes a blue giant star.

A phase in the evolution of a star after nuclear reactions have consumed all the hydrogen in the core of the star, and energy generated by nuclear reactions is now generated in the shell. The star expands, and it becomes a red giant star.

A type II supernova is the end of a massive star's life. After a massive red giant star ejects its outer layers, its hot inner core is exposed, and it becomes a blue giant star.