Red Giant Star Encyclopedia Article

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Red Giant Star

A red giant is a star of average size which has nearly come to the end of its life cycle. A star is typically called a "red giant" if it has a diameter of 10 to 100 times greater than the Sun, and has a surface temperature below about 4000° K.

Stars produce energy by fusing hydrogen atoms into helium. Although a star will fuse hydrogen to helium in this way for billions of years, it eventually exhausts the hydrogen at the core. In the absence of energy stremaing out to counterbalance the inward force of gravity, the core collapses and the hydrogen that remains in the outer shell of the star begins to burn. As the outer atmosphere of the star burns, it expands outward. This expansion cools the surface layers, making the surface appear red.

Meanwhile, the temperature in the collapsing core soars, becoming hot enough in some stars to start fusing the helium atoms into carbon. This can only happen in stars comparable in mass to the Sun; less maassive stars cannot become hot enough in their cores to begin fusing helium, and they will eventually simple fade out when their last reserves of hydrogen are exhausted.

In a star that does fuse helium into carbon at the core, the helium must eventually be exhausted. If the star is massive enough (more massive than the Sun, it turns out), the cycle repeats. This time there is a collapsing carbon core with a shell of helium burning around it, and a larger shell of hydrogen beyond the helium. Depending on the star's mass, this cycle can repeat until there are several shells of fusing material outside the core, and the element being synthesize in the core is iron. At this point, the star reaches a dead end: no element heavier than iron can be synthesized through fusion in a reaction that produces energy to support the star against its own gravity. Only the most massive stars can form iron in their cores, but regardless of the mass, iron is the ultimate dead end.

When the last element the star is massive enough to synthesize has been produced, the star dies. Stars like the Sun eject their outer atmospheres, creating a planetary nebula around the star. Left behind is awhite dwarf. More massive stars explode as a supernova, leaving behind either a neutron star or a black hole.