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Perspective

Astronomical Properties and Core Sequence of Stars

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DESCRIPTION

Stars are the most well-known astronomical objects, and they are the fundamental building blocks of galaxies. As a result, the study of star birth, life, and death is central to the field of astronomy. Stars are born within dust clouds and are dispersed throughout most galaxies. The Orion Nebula is a well-known example of a dust cloud. Deep within these clouds, turbulence creates knots with enough mass that the gas and dust begin to collapse under their own gravitational attraction. The material at the centre of the cloud begins to heat up as it collapses. This hot core at the heart of the collapsing cloud is known as a protostar, and it will one day become a star. Three-dimensional computer models of star formation predict that spinning clouds of collapsing gas and dust may split into two or three blobs, explaining why the vast majority of stars in the Milky Way are paired or in groups of multiple stars.

From the beginning of the collapse to star the size of our sun takes about 50 million years. Our sun will remain in this mature state for about 10 billion years. The stars are powered by the nuclear fusion of hydrogen to form helium deep within their cores. The outflow of energy from the star's central regions provides both the pressure required to keep the star from collapsing under its own weight and the energy that allows it to shine.

Main-sequence stars have a wide range of luminosities and colours and can be classified accordingly. The smallest stars, known as red dwarfs, may have as little as 10% the mass of the Sun but emit only 0.01% as much energy, glowing feebly at temperatures ranging from 3000 to 4000 degrees celsius. Despite their small size, red dwarfs are the most numerous stars in the universe, with lifespans of tens of billions of years. The most massive stars, known as hypergiants, on the other hand, may be 100 or more times more massive than the Sun and have surface temperatures of more than 30,000 K. Hypergiants emit hundreds of thousands of times more energy than the sun but have a few million-year lives. Although extreme stars like these are thought to have been common in the early Universe, they are now extremely rare; the Milky Way galaxy contains only a few hypergiants.

THE FATE OF THE STARS

In general, the larger a star, the shorter its life, though all but the most massive stars live for billions of years. Nuclear reactions stop when a star has fused all of the hydrogen in its core. When the core is deprived of the energy required to sustain it, it begins to collapse into itself and becomes much hotter. Because hydrogen is still available outside the core, hydrogen fusion continues in a shell around it. The expanding hot core pushes the star's outer layers outward, causing them to expand and cool, transforming the star into a red giant. The majority of the star's material is ejected into space, but the core collapses into a neutron star or a singularity known as a black hole. Less massive stars do not explode; instead, their cores contract into a tiny, hot star called a white dwarf, while the outer material drifts away stars smaller than the sun lack the mass to burn with anything other than a red glow during their main sequence. These red dwarves are hard to spot.

However, these may be the most common stars capable of burning for trillions of years. The seven major stages of a star's life cycle are listed above. Stars are one of the most beautiful and lyrical objects in all of creation, whether large or small, young or old. When you look up at the stars, remember that this is how they were created and will die. The main sequence phase is the stage of development in which the core temperature reaches the critical point for fusion to begin. Hydrogen protons are converted into helium atoms during this process. Because this reaction is exothermic, it produces more heat than it requires, and the core of a main-sequence star emits a massive amount of energy.

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