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The night sky has fascinated humanity since ancient times. Long before the invention of telescopes, people observed the stars and used them for navigation, farming, and timekeeping. On a clear night, thousands of stars can be seen scattered across the celestial sphere, forming recognizable patterns known as constellations. Among these countless stars, the Sun is the closest and the most familiar example, providing the energy necessary for life on Earth. Beyond the Sun, there exist many remarkable stars such as Sirius, Alpha Centauri, Vega, and Betelgeuse, each representing distinct stages of stellar evolution.

Stars are not isolated objects. Within massive systems such as galaxies, they are packed together. In addition to billions of stars, a galaxy is made up of compact objects, gas, dust, and dark matter that are all held together by grav-

ity. Our Milky Way Galaxy alone contains hundreds of billions of stars and hosts a supermassive black hole at its center. These stars are essential components of galaxies and have a crucial role in how the universe is shaped. Moreover, stars are cosmic factories. They create the majority of chemical elements present in nature through nuclear fusion. Carbon, oxygen, silicon, iron, and other elements that are necessary for planets and life were created inside stars and released into space when those stars died. Every atom in our body was once a component of a star, in a very real sense.

Thus, understanding the formation, development, and eventual death of stars is crucial to comprehending the evolution of galaxies and the cosmos at large. Stars are born, live, and eventually die, despite their seeming endless nature on human timelines. One characteristic that mostly determines their ultimate fate is mass. While some stars explode violently and leave behind neutron stars or black holes, others gently die as white dwarfs. These compact relics continue to test our knowledge of physics and are among the most extreme objects in nature.

THE BIRTH OF STARS: STELLAR NURSERIES

The story of every star begins within

vast clouds of gas and dust known as nebulae, often referred to as stellar nurseries. The most common and basic element in the universe, hydrogen, makes up the majority of these massive clouds. Some molecular clouds extend across hundreds of light years and contain enough material to form thousands of stars. Star formation begins when a region within a molecular cloud becomes unstable and starts collapsing under its own gravity. A nearby supernova explosion's shock wave, cloud collisions, or gravitational instabilities within a galaxy are some of the possible causes of this collapse. As the cloud contracts, gravitational potential energy is converted into heat, causing the central region to become increasingly dense and hot. During this stage, a young stellar object known as a protostar forms. The protostar continues to gather material from the surrounding cloud through accretion. Around many protostars, rotating disks of gas and dust are developed. These protoplanetary disks may eventually give rise to planets, moons, asteroids, and comets.

As more material accumulates, the temperature and pressure within the core rise dramatically. When the core temperature reaches roughly 10 million Kelvin, continuous hydrogen fusion starts in the core, resulting the birth



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