

Star birth

Stars have been forming throughout the Universe for most of its life. They take shape in vast clouds where thousands of stars are born at a time.

The clouds that give birth to the stars are cold and dense and consist mainly of hydrogen gas. The newly formed stars are huge spinning globes of hot, glowing gas—mainly hydrogen, with helium and small amounts of other elements. Much of this material is packed tightly into the stars' cores, and it is here that nuclear reactions release energy in the form of heat and light.

The largest stars
in the night sky are big enough to swallow our Sun a billion times.

How new stars form

The star-forming process begins when the cloud becomes unstable and breaks up into fragments. Gravity pulls the material in a fragment into an ever-tighter clump, and the clump slowly forms a sphere as it shrinks. Now a protostar, this star-to-be keeps on shrinking, its core getting denser and hotter. Eventually the pressure and temperature are so high that nuclear reactions begin, and the star starts to shine.

Interstellar gas cloud

Cloud breaks up into fragments

Protostar

Rotating disc



1 Interstellar cloud
Stars are born within enormous, cold, dense clouds of gas and dust. The process of star formation may be triggered if something disturbs the cloud, such as a collision with another cloud or a shockwave from a supernova explosion.

2 Fragments form
Now unstable, the cloud breaks up into fragments of different size and mass. The most massive and dense of these fragments are gradually pulled by their own gravity into tighter clumps. These shrinking fragments will eventually turn into protostars.

3 Protostar
A protostar forms. Gravity pulls material into its core, where the density, pressure, and temperature build up. The more matter the original cloud fragment contained, the greater the temperature and pressure rise as the protostar develops.

Starbirth nebulae

Clouds of gas and dust in space are called nebulae. Much of the gas and dust in a nebula is debris from old stars that exploded when they ran out of fuel. Over millions of years, this material is recycled to make new stars. Starbirth nebulae are among the most beautiful objects in space, their colorful clouds illuminated from within by the blue light of newborn stars.

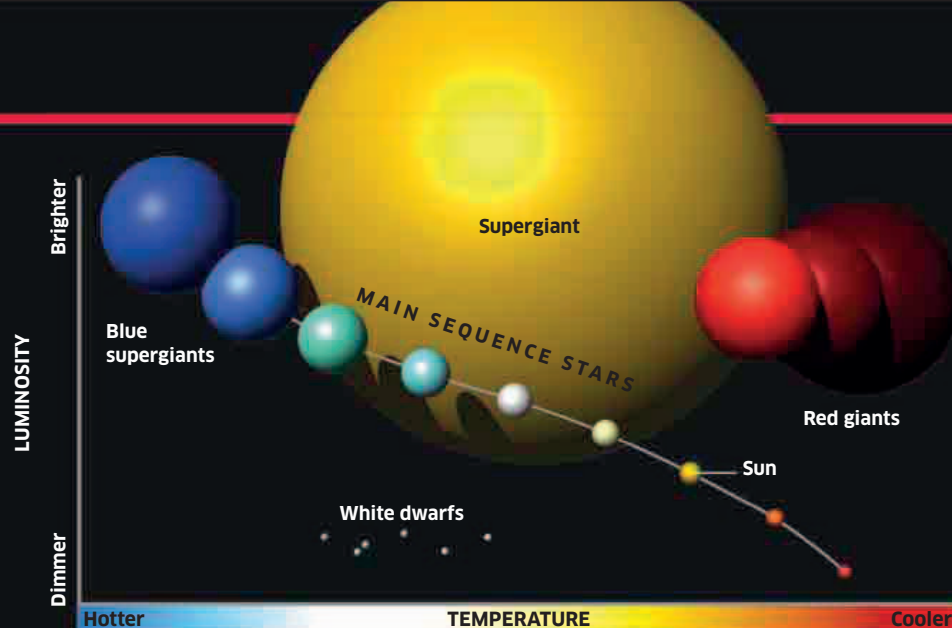
Orion Nebula

The Orion Nebula is one of the closest star-forming regions to Earth. In the night sky it looks like a fuzzy star in the sword of Orion. In reality, it is a vast cloud of gas and dust thousands of times bigger than the Solar System.



Types of star

A star begins to shine when nuclear reactions in its core convert hydrogen into helium and release energy. It is then called a main sequence star. Not all main sequence stars are the same—they differ in size, temperature, color, brightness, and the amount of matter they contain. When stars begin to run out of fuel and near the end of their lives, they stop being main sequence stars and may swell up and turn into red giants or shrink to become white dwarfs.



Classifying stars

The Hertzsprung-Russell diagram is a famous graph that astronomers use to classify stars. The graph plots brightness against temperature and reveals that there are distinct groupings of stars, such as red giants (dying stars) and main sequence stars (ordinary stars). Astronomers also classify stars by color, which is linked to their temperature: hot stars are blue; cooler stars are orange or red.



4 Spinning disc

The growing mass at the center creates a gravitational pull, drawing ever more gas and dust inward. A little like water going down a drain, the material being pulled in starts to spin around. Powerful winds develop, blowing jets of gas out from the center.

5 A star is born

Squeezed by the force of gravity, the protostar's core becomes so hot and dense that nuclear reactions occur, and the star begins to shine. The glowing core produces an outward pressure that balances the inward pull of gravity, making the star stable. It is now a main sequence star.

6 Planets form

Not all the material from the gas cloud has been used to make the star. The leftovers form a spinning disc of gas and dust around the star. This debris may be lost into space, or it may clump together to form planets, moons, comets, and asteroids.

Star clusters

Stars are not formed singly—they are born in clusters from the same cloud of material at roughly the same time. Eventually, the stars of a cluster will drift apart and exist alone in space, or with a close companion or two. Our Sun, like about half of the stars nearest to us, is alone. About a third of the stars in the night sky are in pairs, bound together by gravity.

Pleiades cluster

A handful of the 5,000 or so stars that make up the Pleiades cluster can be seen with the naked eye. In about 250 million years time, the stars will have dispersed and the cluster will no longer exist.

