

The formation and life cycle of stars

Dr Dransfield: How are stars formed and what is their life cycle?

The life cycle of stars begins with a cold cloud of dust and gas, called a Nebula.

Gravity pulls the particles together until the nebula collapses.

A hot sphere forms, called a Protostar.

The core gets hotter and denser.

Then, nuclear fusion begins.

Light nuclei, like hydrogen, fuse to form heavier nuclei, like helium.

For a stable star like this one, the outward force caused by fusion balances with the inward force due to gravity, meaning that the forces are in equilibrium.

This is known as the Main Sequence stage of the star's life.

Our Sun is a main sequence star.

A star's final fate depends on its mass.

Stars with similar or less mass than our Sun will eventually swell into a Red Giant, which our Sun will do in about five billion years.

The outer layers shed into space, leaving behind a dense White Dwarf.

Stars more massive than the Sun have hotter cores that can fuse heavier and heavier nuclei together, until heavy elements are formed.

As fusion progresses, the core contracts while the outer layers expand.

This is called a Red Super Giant.

Only elements with atomic numbers up to Iron can be formed in a star's core.

As the nuclear fuel runs out, the outward force due to fusion becomes weaker than the inward force due to gravity.

The star rapidly collapses, triggering a massive Supernova explosion.

All that is left is the very dense collapsed core, called a Neutron Star.

Remnants of the most massive cores are so dense that they form Black Holes with a gravitational force so strong that nothing, not even light, can escape.

So, before describing a star's life cycle, be sure to consider its mass, since this determines its final stages.

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