What is a pulsar?

KS2 KS3 Ages 9-14 ⏰ 2 min read

A **pulsar** is one of the most extraordinary objects in the universe: a dead star that spins incredibly fast while shooting powerful beams of energy into space. When we detect these beams sweeping past Earth, they create regular pulses of radio waves — which is how pulsars got their name.

When Stars Die Dramatically

Pulsars are born when massive stars — at least eight times heavier than our Sun — reach the end of their lives. Instead of quietly fading away, these enormous stars explode in spectacular events called supernovas. The explosion is so violent that it crushes the star's core into something almost impossibly dense: a ball of neutrons about 20 kilometres across.

This neutron star is so dense that a teaspoon of its material would weigh as much as Mount Everest. The star's magnetic field becomes trillions of times stronger than Earth's, and it starts spinning at ridiculous speeds — sometimes hundreds of times per second.

Think of a figure skater pulling in their arms during a spin. As they get smaller, they spin faster. When a massive star collapses into a tiny neutron star, the same thing happens — but instead of spinning a few times per second, it can spin 700 times per second.

Cosmic Lighthouses

The pulsar's incredibly strong magnetic field accelerates particles to nearly the speed of light, creating two narrow beams of energy that shoot out from the star's magnetic poles. As the pulsar spins, these beams sweep through space like the light from a lighthouse.

If Earth happens to be in the path of one of these beams, we detect a pulse of radio waves each time the beam sweeps past us. The timing is so precise that some pulsars keep better time than the most accurate atomic clocks on Earth.

Why Pulsars Matter

Scientists use pulsars as natural laboratories to study extreme physics that we can't recreate on Earth. They've helped us test Einstein's theories about gravity and time, and they've even been used to search for gravitational waves — ripples in spacetime itself.

The first pulsar was discovered in 1967 by Jocelyn Bell Burnell, a graduate student who initially thought the strange, regular signals might be coming from aliens. Today we know of over 3,000 pulsars, each one a testament to the incredible forces at work in our universe.