What is a supernova?

KS2 KS3 Ages 7-14 ⏰ 3 min read

Stars don't live forever. Our own sun has about 5 billion years left — but much bigger stars live fast and die spectacularly. When a massive star reaches the end of its life, it explodes in one of the most violent events in the entire universe. That explosion is called a **supernova**.

Why stars explode

Stars spend their lives doing a constant balancing act. Gravity is always trying to crush them inward. But nuclear fusion in the core — the process of smashing hydrogen atoms together to make helium — releases enormous amounts of energy that push outward and keep the star inflated.

For millions or billions of years, these two forces balance perfectly. But eventually, the star runs out of fuel. When the core can no longer produce enough energy to push back, gravity wins — catastrophically. The core collapses inward in a fraction of a second. The outer layers slam into the collapsing core and bounce back outward in a colossal explosion.

Imagine a beach ball being held up by a constant stream of water from a hose. The moment the water stops, the ball collapses instantly. Now imagine that collapse happens so fast that the air rushing in hits the floor and bounces back outward as a shockwave that destroys everything nearby. That's roughly what happens to a star's outer layers when its core collapses.

How bright is a supernova?

For a few weeks, a supernova can outshine an entire galaxy — billions of stars — all on its own. In 1054 AD, a supernova in our galaxy was visible in daylight for three weeks. Chinese and Arab astronomers recorded it. What it left behind is what we now call the Crab Nebula: a gorgeous, expanding cloud of gas still visible through telescopes today.

What's left behind

After the explosion, the remnant of the core either becomes a **neutron star** (an impossibly dense object about the size of a city) or, if the original star was massive enough, a **black hole**. The exploded outer material forms an expanding cloud of gas and dust called a **nebula**.

Why supernovae matter to you

Almost every atom in your body heavier than iron was forged in a supernova. Gold, silver, calcium, zinc — the universe's nuclear fusion can only make elements up to iron. Everything heavier requires the extraordinary energy of a supernova explosion to create. So in the most literal possible sense, you are made of stardust.