What happens when two black holes collide?

KS3 KS4 Ages 11-16 ⏰ 2 min read

Imagine the most powerful collision in the universe — two **black holes** spinning around each other faster and faster until they crash together. These aren't just any objects bumping into each other. Black holes are regions where gravity is so strong that not even light can escape, and when they collide, something extraordinary happens.

The Death Spiral

Before black holes actually touch, they perform a deadly dance that can last millions of years. They orbit each other, gradually getting closer as they lose energy. Think of it like water going down a plughole — the closer they get, the faster they spin around each other. In the final moments before collision, they're whipping around each other hundreds of times per second.

Picture throwing a stone into a perfectly still pond. The ripples spread out in circles from where the stone hit. When black holes collide, they create ripples in space and time itself, spreading out across the entire universe at the speed of light.

The Moment of Impact

When the black holes finally merge, they don't crash like cars in an accident. Instead, their event horizons — the invisible boundaries around them — stretch and wobble like soap bubbles joining together. The collision releases more energy in a split second than all the stars in our galaxy produce in an entire year. But here's the weird bit: you wouldn't see a flash of light because black holes don't give off light.

Gravitational Waves

What we can detect are **gravitational waves** — those ripples in spacetime itself. These waves are incredibly faint by the time they reach Earth. When scientists first detected them in 2015, the waves had stretched and squeezed space by less than

1/10,000th the width of a proton. That's like detecting a change smaller than an atom in a distance stretching to the nearest star.

The newly formed black hole settles down into a perfect sphere, but it's now more massive than the two original black holes combined. Some of their mass gets converted into pure energy and carried away by those gravitational waves — Einstein's famous $E=mc^2$ equation in action on the grandest possible scale.