What is the cosmic web?

KS3 Ages 11-14 ⏰ 6 min read

If you could zoom out from Earth — past the Moon, past the Sun, past our galaxy, past thousands of other galaxies — and keep going until the entire observable universe fitted on your screen, you'd see something astonishing. The universe isn't a random scatter of stuff. It's arranged into an enormous, intricate structure that looks remarkably like a spiderweb.

Scientists call it the **cosmic web**.

What does it actually look like?

The cosmic web has three main parts:

Filaments — these are the threads of the web. Long, thin strands made of gas, dark matter, and galaxies, stretching hundreds of millions of light-years across space. They're the scaffolding of the universe.

Nodes — where the filaments cross, you get massive clusters of galaxies, all bunched together by gravity. These are the busiest, densest places in the universe.

Voids — the huge empty spaces between the filaments. These aren't completely empty — there are a few lonely galaxies in there — but they're about as close to nothing as the universe gets. Some voids are hundreds of millions of light-years across.

🕷️ Imagine a giant spiderweb covered in dew drops. The threads are the filaments — strands of galaxies connecting everything up. The dew drops where threads cross are galaxy clusters — the dense, busy intersections. And the gaps between the threads? Those are the voids — vast stretches of nearly nothing.

Why is the universe shaped like this?

It all goes back to the Big Bang — and tiny imperfections in it.

In the very early universe, matter wasn't spread out perfectly evenly. Some regions were ever so slightly denser than others — talking about differences of less than one

part in a hundred thousand. But over billions of years, gravity amplified those tiny differences.

Denser regions pulled in more matter. That matter formed into the first stars and galaxies. Those galaxies attracted more matter along gravitational lines, forming filaments. The less dense regions got emptier and emptier as their matter was pulled away — becoming the voids.

In short: gravity, given enough time, turned a nearly-smooth explosion into a web.

How do we know it's there?

Astronomers have mapped the positions of millions of galaxies across the sky and plotted them in three dimensions. When you look at the resulting map, the web structure leaps out immediately — it's one of the most striking things in all of science.

Projects like the Sloan Digital Sky Survey have mapped huge slices of the universe and produced images that look almost identical to computer simulations of the cosmic web. Real data and theory match up beautifully.

How big is it?

The cosmic web spans the entire observable universe — about 93 billion light-years across. The filaments themselves can be hundreds of millions of light-years long. The Hercules–Corona Borealis Great Wall, one of the largest known structures in the universe, is estimated to be around 10 billion light-years long.

To put that in perspective: our entire Milky Way galaxy is about 100,000 light-years across. The cosmic web makes our galaxy look like a single grain of sand on a very long beach.

Does it keep going?

The cosmic web is still evolving. As the universe expands, the voids get bigger and emptier. The filaments and clusters grow denser as gravity continues its slow work. In the very far future, the web's structure will become more extreme — with matter concentrated into ever-tighter knots, separated by ever-vaster stretches of emptiness.

It's the largest thing that exists — a structure so vast it's made of galaxies the way a spider's web is made of silk. And it's been quietly forming for nearly 14 billion years.