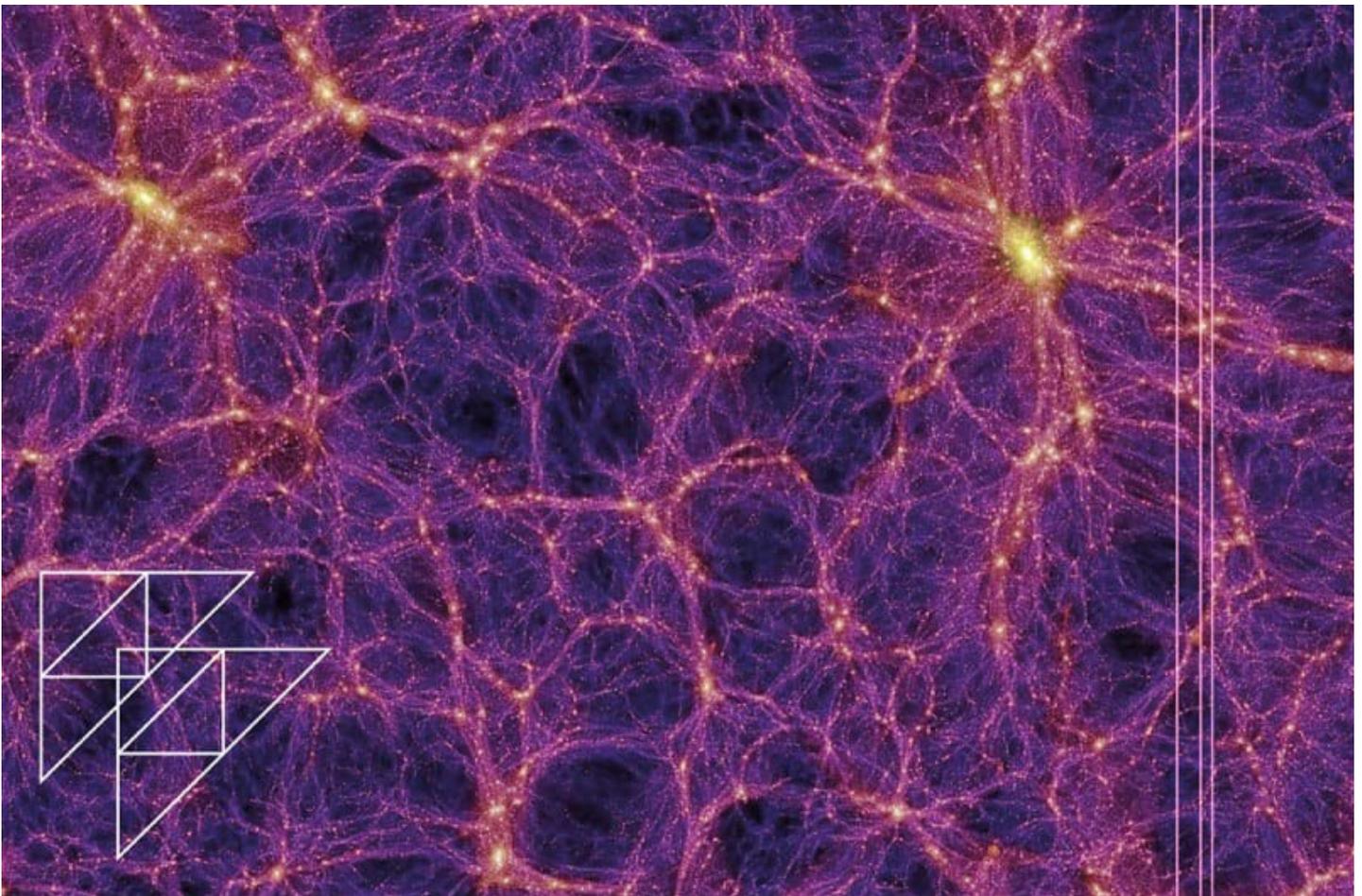


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10 mysteries of the universe: Is Earth in a special place?

From Copernicus on, we've resisted the idea that Earth has a special place in the cosmos. Whisper it, but recent discoveries suggest that's not the whole truth



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Mystery: Are we in a special place?

OUR entire cosmology is built on the idea of our own unremarkableness: that we're nothing special and neither is Earth.

The idea dates back to the Renaissance, and Copernicus's discovery that Earth

revolves around the sun. Suddenly we were no longer at the centre of Creation.

[Read more: 10 mysteries of the universe](#)

From dark matter and energy to our own enigmatic existence, here's our pick of the greatest cosmic conundrums – told through the bizarre objects embodying them

It has since become clear that Earth is just another planet orbiting just another star in a galaxy like many others, and Copernicus's discovery has morphed into the Copernican principle: that, on average, nowhere in the universe is particularly special. Everything looks the same, and there are no remarkable places. The assumption is absolutely baked into our current models of the universe, built on Einstein's [general theory of relativity](#).

Central to the Copernican principle is the idea of scale. Imagine the universe as a crowd of people. Up close you can see individual quirks. Zoom out enough, though, and all you see is a uniform lump of person.

So while on smaller scales the universe is very distinctive, made up of individual solar systems, galaxies and clusters of galaxies, at some scale, generally taken to be about a billion light years, those differences disappear. Averaged out, the web of stuff that makes up the universe looks homogeneous.

Various challenges to this idea have emerged recently. Perhaps the biggest is the [BOSS Great Wall](#), discovered in 2016. Named after the Baryon Oscillation Spectroscopic Survey that discovered it, the "wall" is really a huge filament of nearly a thousand galaxies, strung out over a billion light years.

The Virgo supercluster, a dense patch of galaxies including our Milky Way, seems to be part of something much bigger, too. "We are living in the outskirts of a large supercluster named Laniakea," says András Kovács at the Institute for High Energy Physics in Barcelona, Spain. Demarcated in 2014, it is 500 million light years across. That same year, we also discovered a vast empty patch known as a [super-void right by us](#), stretching 2 billion light years across.

All in all, we might be occupying a rather unusual spot in the universe, between a large supercluster on one side and a super-void on the other. "Such a scenario might be a rare configuration in the cosmic web," says Kovács.

That need not spell the end for the Copernican principle, says [Brent Tully](#) of the Institute for Astronomy in Hawaii: perhaps our odd positioning just makes it harder for us to see a universe that is homogeneous overall. Tully is working to stretch our maps further out into the universe, doubling the distance over which homogeneity is measured.

[But at some point we reach a limit](#). "If inhomogeneous patches are larger than this scale then that would challenge our current standard paradigm," he says. If we identify anything much bigger than the BOSS Great Wall, the disturbance to the fabric of space-time caused by its huge mass could even change our calculations of how fast the universe is expanding, and hence its current age. At the moment, [two competing measurements of the universe's expansion rate don't agree](#). Extra

lumpiness could be the key to solving that – and unlocking the door to more specialness.

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