

16 of 17 DOCUMENTS

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You're Not the Center Of the Universe, You Know

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Walk into an open field on a clear, moonless night. Overhead, sparkling stars sprinkle the sky. All of them seem equidistant from you -- and no one else -- and you are lulled into imagining yourself at the center of the universe.

For nearly 500 years, astronomers have struggled to break that illusion. Our petty standing in the cosmos is a scientific fact, if not a visceral experience. Earth zips at nearly 67,000 miles an hour around the sun, which in turn completes one lap around the Milky Way every 220 million years, meaning that the last time we were in this neck of the galaxy, dinosaurs were getting ready to rule the planet. Still, as you look skyward in that pitch-black field, Earth seems to be at the heart of all creation.

We could blame Aristotle. So authoritative was his pronouncement of an Earth-centered universe in the 4th century B.C. that few challenged the idea for nearly two millennia. Over time, the urge to better explain the universe's behavior gave rise to new models. In 1543, Nicolaus Copernicus boldly placed the sun at the center of the universe, shoving the Earth into motion. The radiant sun was at last in its proper perch, "as if resting on a kingly throne," he wrote.

Copernicus was not disturbed at all by a moving Earth but was troubled by a rotating sky. The Polish mathematician and astronomer, though, knew quite well the consequences of challenging conventional notions. In the preface to his great work, "On the Revolutions of the Heavenly Spheres," he predicted that "as soon as certain people learn that in these books of mine . . . I attribute certain motions to the terrestrial globe, they will immediately shout to have me and my opinion hooted off the stage."

That fate fell upon Galileo, who starting in 1609 gathered the crucial evidence supporting Copernicus's heliocentric vision. In 1633 he was brought before the Inquisition and eventually put under house arrest for daring to oppose an Earth relaxing at the universe's center.

By the time of Newton, decades later, such hostility had faded. For one, Sir Isaac's physics could at last explain why we aren't thrown off the planet as the Earth rotates and orbits the sun. But even though Copernicus moved Earth from the hub of the solar system, its inhabitants remained confident that they retained a privileged place at the center of the

Milky Way, the sole galaxy. Homo sapiens is an egotistical species; we resist being kicked out of a prime spot in the cosmic scheme of things.

That confidence, though, withered as astronomy underwent a spectacular transformation starting in the 19th century, an era teeming with technological innovation. Prominent industrialists, enriched by the Gilded Age, provided the money that allowed dreamers to construct the powerful telescopes they had long desired.

With one of those new instruments atop California's Mount Wilson, Harlow Shapley resized the Milky Way. He discovered in 1918 that it was 10 times larger than previously thought and, along the way, he relocated the sun and its planets into the galaxy's suburbs. The sun resides roughly 30,000 light-years from the galactic center, more than halfway to the Milky Way's edge. "The solar system is off center, and consequently, man is too," Shapley liked to say.

But Shapley did not take the next step; he, too, fell victim to cosmic pride. Despite the growing evidence that the Milky Way was not alone in the universe, he held fast to his beloved Big Galaxy model: Our galaxy remained at center stage. We lived in a solitary, star-filled oasis suspended in a darkness of unknown depth.

Shapley's vision was demolished in 1924, when Edwin Hubble proved that the cosmos is populated with myriad galaxies as far as the telescopic eye can see. The Milky Way suddenly became a bit player in a much larger drama.

The history of astronomy is a continuing extension of the Copernican principle, moving us farther and farther from the front row. It's a principle of irrelevance that involves not only our position in space and time but also the contents of the universe. In recent decades, astronomers have learned that a hidden ocean of cosmic matter -- comprising about 85 percent of the universe's mass -- surrounds us, possibly elementary particles yet to be discovered. The stuff of stars, planets and us is but the flotsam in this enveloping sea.

More startling -- and taking the Copernican principle to its finale -- our universe may not be the only one. As physicists attempt to construct a theory that unifies all the forces of nature, one theme repeatedly arises: that additional cosmic realms may be lurking in other dimensions. We could be part of the multiverse; the Big Bang might have occurred when universes outside our dimensional borders bumped into one another.

The main response to this astounding theory has been to bury our heads in terra firma. Yet such a wider perspective offers some succor, allowing our earthly concerns to shed away. Hubble knew this. During a visit to the astronomer's home, the English poet Edith Sitwell was shown slides depicting the many galaxies that cannot be seen with the naked eye. "How terrifying!" she exclaimed. To which Hubble replied: "Only at first -- when you are not used to them. Afterwards, they give one comfort. For then you know that there is nothing to worry about -- nothing at all."

Granted, the hugeness of the cosmos is difficult to perceive and, as Sitwell expressed, horrifying to ponder. A character in Thomas Hardy's 19th century novel "Two on a Tower" gives splendid voice to this apprehension: "There is a size at which dignity begins; further on there is a size at which grandeur begins; . . . further on, a size at which ghastliness begins," says astronomer Swithin St. Cleeve. "That size faintly approaches the size of the stellar universe."

Indeed, our cosmic address is getting excruciatingly long: Planet No. 3, Solar System, Orion Spur on the Sagittarius Spiral Arm, Milky Way, Local Cluster, Virgo Supercluster, Universe, Multiverse.

It's time for earthlings to acknowledge our minor-league status and collectively grasp the magnificent vastness that engulfs us all. While a widespread recognition of Earth's humble station is unlikely to end conflict here, fully comprehending our planet's infinitesimal place in the universe might be a modest step toward diminishing our hubris. Earth is but a speck, the cosmic equivalent of a subatomic particle hovering within an immensity spanning billions of light-years.

And we can still savor our cleverness in figuring this out.

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