In the 20th century, the universe became a story—a scientific one. It had always seemed a static, unchanging place. Then astronomers saw that other galaxies were flying away from ours. Physicists, pondering Einstein's new equations, realized the universe itself was expanding—which meant it had once been smaller. It had seemed eternal; now it had a beginning and end. What beginning? What end? Some questions are still open.

COSMIC QUESTIONS

SCROLL

COSMIC QUESTIONS

FADE OUT TOWARD THE TOP

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COSMIC QUESTIONS

SCROLL

HOW DID OUR UNIVERSE BEGIN?

INFLATION

In far less than a nanosecond, a repulsive energy field inflates space to visible size and fills it with a soup of subatomic quarks.

AGE: 10^{-35} SECONDS
SIZE: INFINITESIMAL

SLIDE AND FADE IN FROM THE BOTTOM AS COSMIC QUESTIONS FADE OUT

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HOW DID OUR UNIVERSE BEGIN?

EARLY BUILDING BLOCKS

As the universe expands, it cools. Quarks clump together to form protons and neutrons, the building blocks of atomic nuclei.

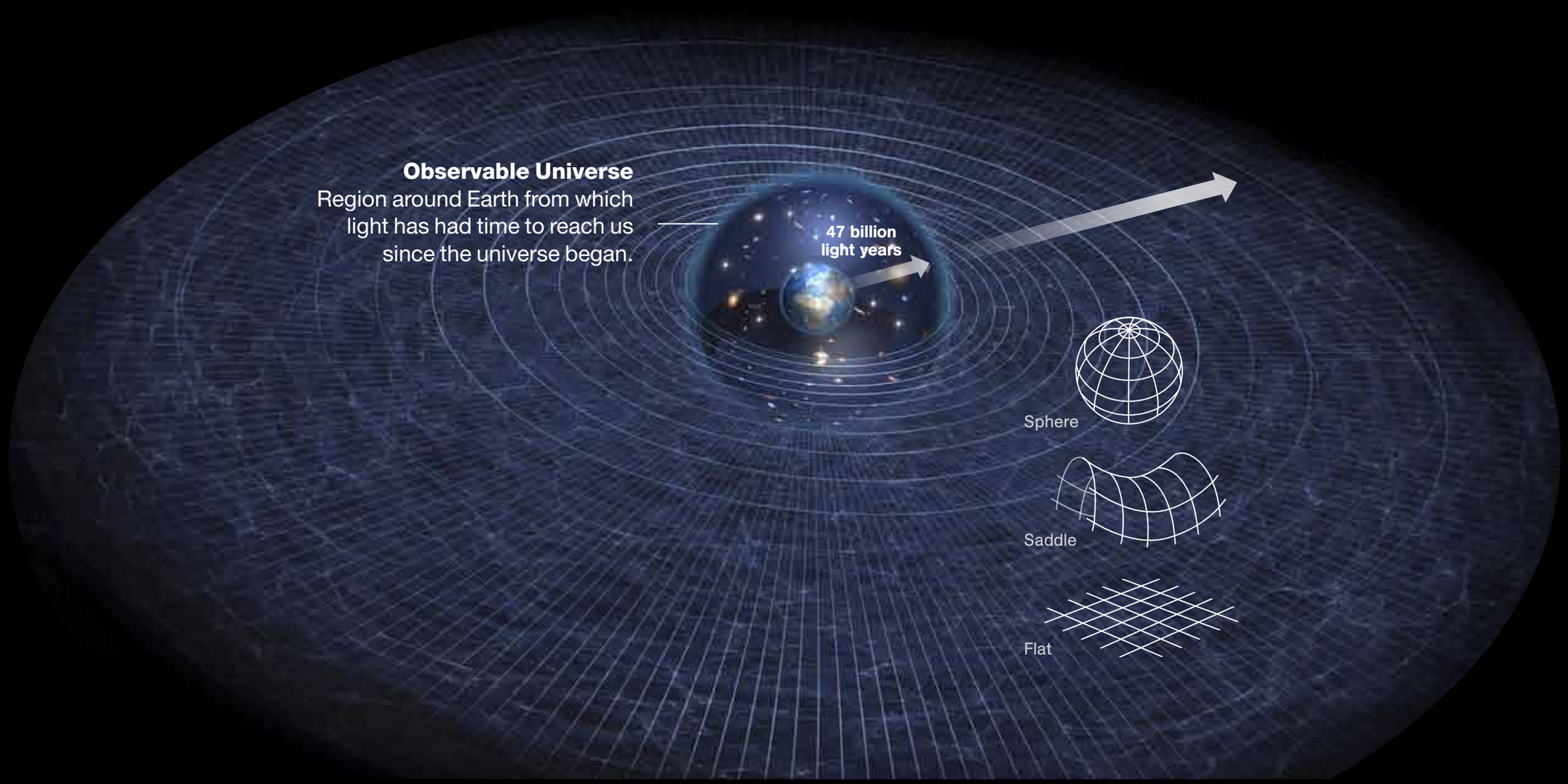
.00001 SECONDS
.1 TRILLIONTH PRESENT SIZE

WHAT IS THE UNIVERSE MADE OF?

Stars, dust, and gas—the stuff we can see—make up less than five percent of the universe. Their gravity can't account for how galaxies hold together. Scientists figure about 20 percent of the universe is a mysterious dark matter—perhaps exotic particles formed right after the Big Bang. The other 75 percent is dark energy: an unknown energy field or property of space that counteracts gravity. It's needed to explain observations that the expansion of space is accelerating.

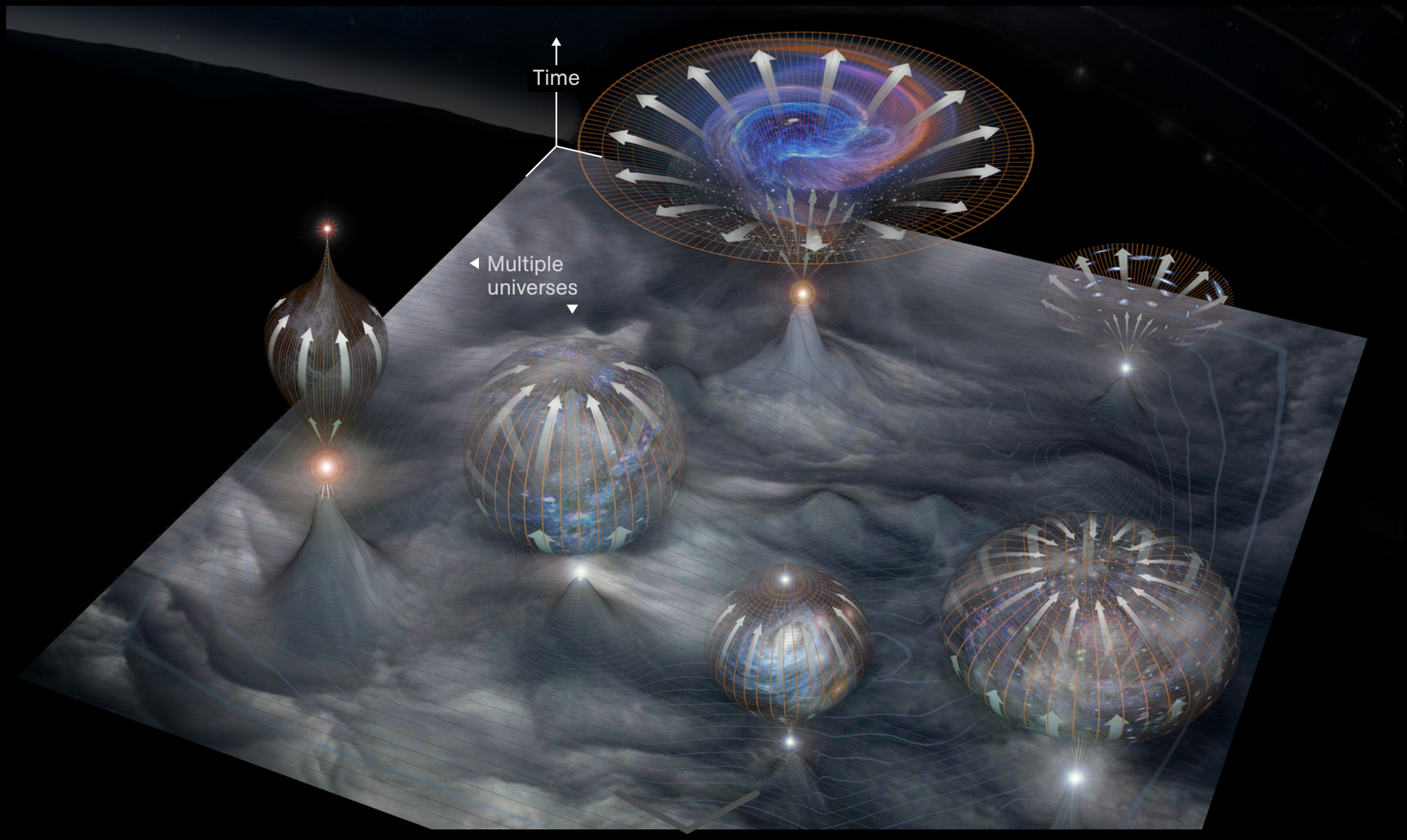
WHAT IS THE SHAPE OF OUR UNIVERSE?

We've known since Einstein that a star's gravity curves space around it. But is the whole universe curved? Might space close up on itself like a sphere, or curve the other way, opening out like a saddle? By studying the cosmic background radiation left over from the Big Bang, scientists have found that the universe is poised between the two: just dense enough with just enough gravity to be almost perfectly flat—at least the part we can see. What lies beyond 13.8 billion light-years away, we can't know.



DO WE LIVE IN A MULTIVERSE?

What came before the Big Bang? Maybe other Big Bangs. The uncertainty principle says even the vaccuum of space has subatomic energy fluctuations. Inflation theory says our universe exploded from such a quantum fluctuation—a random event that, odds are, happened many times before. Our cosmos may be one in a sea of others just like ours, or nothing like ours. If so, they may remain forever inaccesible to observation, their possibilities limited only by our imaginations.



HOW WILL IT END?

Which will win in the end, expansion or gravity? Is the density of matter and energy enough for gravity to halt or even reverse cosmic expansion, leading to a Big Crunch? It seems unlikely—especially given the power of dark energy, a kind of anti-gravity. Perhaps the acceleration in expansion caused by dark energy will trigger a “Big Rip” that shreds everything from galaxies to atoms. If not, the universe may expand for hundreds of billions of years, long after all stars have died.