The View from the Center of the Universe: Part II
A sermon by Rev. Steven Epperson
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Last week, we explored how our ancestors described the cosmos. We learned that up until about 350 years ago, their cosmologies placed the earth and the human family at the center of the universe. In this picture, the heavens were near, influential and meaningful; under the cope of the heavens, humans strove to order their lives, institutions and faiths in ways that would reflect and resonate with the orderly patterns they beheld in the skies. They did this believing that their individual and collective destinies, the future and the well-being of the world, were at stake.

All of that changed in the 1600s. Direct observation and theories of the heavens disclosed that ours was one of several planets circling the sun; that our sun was just one of numberless stars scattered in a cosmos governed by impersonal laws of nature; and that space—rather than a sheltering sky—was terrifyingly vast, empty, and indifferent. In response to that new picture of things, people either clung on desperately to pre-modern cosmologies—or accepted the Newtonian picture that left humans drifting in a kind of cosmic homelessness that persists to this day. One outcome of this second option—let's call it the *existential view*—is that there is no "ultimate nature of reality," that the universe is inherently meaningless. In this view, the grown-up, adult response is that we are totally free to create our own meaning; we are responsible for coming up with our own personal interpretations of reality. It's a heavy responsibility, one I respect deeply; but one in which each person is left to make endless decisions essentially alone.

This view, which pretty much sums up the way a lot of people look at things—a view that can wreak a lot of damage on our emotional and interpersonal lives and on the ways we approach

economics and the environment—may have run its course, if we're lucky, because it's based on an outmoded, Newtonian view of the cosmos.

So last week, we ended with the following quote by the astrophysicist Joel Primack:

"Scientific cosmology today has entered a golden age of discovery…Data is flooding in, and cosmological theories are being honed to levels of precision unimaginable even a generation ago. We may see in the first decades of the 21st century the emergence of a new universe picture" and with it the possibility "that the…centuries-long break in the human connection with the universe will end…[F]or those who continue to seek truth, whether through science or spirituality, there will be a [new] universe for our time. This universe could become the most inspiring source of new ways of interpreting and addressing the problems of our planet."

So here are my questions: what are the new data and theories telling us? What's the new universe picture coming into view? And how can that information and that new cosmology inspire us to address key problems facing our planet, our future? And in twenty something minutes!

Here's the basic claim, according to Primack, the astrophysicist and his partner Nancy Abrams: "The astonishing truth that science has just discovered" is that "in an expanding universe, human beings are not only significant, they are…are cosmically central or special in at least seven fascinating ways…all of which follow directly from the *principles* of modern astrophysics." Those seven ways are represented by the icons printed in the order of service. Let's look at the first, the pyramid, the first feature of our new universe portrait. A detailed version is on the page to the right.

And here's the first claim: *We are made of the rarest material in the Universe: Stardust*. We are "citizens of the luminous and rare;" not specks of dust, but concoctions of atoms made of material created and ejected into the Galaxy by supernovas—by supersized stars that exploded before our solar system was formed four and half billion years ago. Fifty times a second, a

supernova occurs in some galaxy in the visible universe. When the stars come to the end of their lives, they explode and spew out into space enormous quantities of elements forged in their fiery furnaces that travel millions of light years before falling into the gravitational field of some newly forming galaxy, solar system, and in the rarest of cases, they coalesce in us.

That alone tells us, that space, far from being empty, is crisscrossed with gravity-influenced cosmic concourses carrying atomic elements in restless flowing motion throughout space until gravity ropes those elements in and pulls them home. We and our planet are inextricably linked to the stars, and our bodies literally hold the history of the universe, witnessed and enacted by atoms whose organization makes up who we are.

We're also "rarer than radium," Dylan Thomas wrote, and he's right. Stardust represents only 1/100th of one percent of the density of universe, but 90% of the weight of each of us. And the wild thing is, all the atomic matter in the universe makes up only about 4 ½ % of its total density. *Density, not emptiness*. If space isn't empty, what's out there? Dark Matter and Dark Energy, unknown until the late 1990s; they fill up most of the density of the cosmos and we can't even see them. Like secret gardeners and companions, we know they are there because of what they do—Dark Matter shapes the galaxies and superclusters of galaxies; it holds them together as they spin. The beautiful spiral galaxies we observe through telescopes, including our own Milky Way are only the glowing centers of enormous dark halos of matter that extend at least ten times the radius of the disk of visible stars. And Dark Energy?—it's the most powerful ingredient in the universe. Again, though we can't see it, we deduce that it exists because it alone can explain why the universe is rapidly expanding.

The universe is far larger and more mysterious than those 17th century people imagined, and though we constitute only a minute portion of its body, we are significant because of the

amazing complexity of our minds. We can conceive what no amount of dark matter and energy can ever do. That glowing tip at the apex of the pyramid is us; we look out and give meaning to its dark mute mass.

Where the first icon was about density, the second icon and third icons are about space/time; they tell us *we live at the center of our visible universe and at the midpoint in the evolution of the cosmos.* That is, we exist in the middle of what's going to be the story of *our* universe, one that began about 14 billion years ago, and now is the best time for gathering information and creating its narrative. Look at the point in the middle of the icon in the upper right; that's us looking out into the cosmos. Imagine the circles beyond as the shock waves of space-time. Remember, when we look into the heavens, the farther away from us things are—stars, galaxies, the cosmic horizon—the farther back in time they are. Astronomy is cosmic archaeology; the deeper we look out, the farther back we delve.

The first circle represents light that started its journey toward us when the sun and earth formed about 4.5 billion years ago. The next circle takes us further back, to within several hundreds of millions of years after the Big Bang; here we see strong evidence that the universe is an evolving and changing thing. Larger galaxies had coalesced from others further back in time that were smaller, irregularly shaped but very bright because they were forming stars rapidly. Beyond that, the farthest circle represents the time only 400,000 years after the Big Bang, when a hot plasma-fog from the explosion dissipated, electrons combined with nuclei to form atoms, and the universe became transparent to light. And that's as far as we can see. The sharp details of this evolving universe picture, accompanied by the ability to calculate the factors of time, have only come into view in the past decade.

Picture this with me as we transition from the second to the third icon. Imagine that a big group of people are all huddled incredibly close together surrounded by a thin elastic filament of thread. We're feeling lively and claustrophobic all massed in close. All there is—all mass and energy—is concentrated in that huddle, and there's nothing outside us, there's only us and that restless got-to-hit-the-roadness. And then, about 14 billion years ago: Bang! The Big Bang and we start moving away from each other, step by step. At first, we're so close to each other, so new, that we can't make each other out, nor do we have anything like a story to tell. Over time we're spreading out.

Four things are crucial here. First, when we see each other, we're looking down the cone of time and into our remote past; we've acquired a history from that first huddling together. And that's the story all our measuring and theorizing is enabling us to piece together. And here we are writing the universe story.

Second, there is no center. Each of looks out as we're on the move, and from each vantage point, *there* is the center of things for the person looking back, around, and away. That's what it looks like from each "observer" on each planet, star, and galaxy in the universe. Third, figuratively, we're still holding on to that fine thread that connects each person to the other. As we move out and away, so does that connecting filament; it marks the place from which we busted out—at first so infinitesimally small—and now it marks the outer boundary of our journey. That edge, that boundary keeps expanding as we move further and further away in time and space.

Right now we're in the middle of being on the road. Look at the icon that looks like an hourglass. With our advanced instruments looking back into the well of time, we can see where we came from when we first broke loose at the Big Bang, and we can see that fine thread that

marks the outer boundary moving away (from bottom of the hourglass to the top). And that's where we are, in the middle of the game; but not for long, that's the fourth point to remember in our on-the-road story. In the future, (that's the top of the hourglass) our companions, that once huddled in so close to us, will have moved out so far away that they will disappear over the horizon. In far distant time, we'll look out into the heavens, and the companionable stars, galaxies that dappled our night skies will have disappeared from view. That's why, if you're a cosmologist, the present time in which we live is so precious: it is the central, peak period in the evolution of the universe for astronomical observation, and with it, the possibility for telling the story of where we came from, where we are and where we're going. (Primack and Abrams, 130-56)

Let's look at the next icon—a detail of which is on the page to the right. It's an ancient symbol of a snake swallowing its tail—a symbol of timelessness and the unity of things. It's also an interesting coincidence that it's the symbol of our Transylvanian Unitarians, and represents the words of Jesus to his disciples to be "wise as serpents and harmless as doves." Here's the spooky wisdom: again, our new universe story tells us *we are at the center of things, not just for observing the density, extent and time of the cosmos; as well, we reside at the sweet, crucial midpoint in its volume.* Look at the outside numbers marked out at lengths on the snake: they represent orders of magnitude. What's being measured here is cosmic volume. From mouth to tail, from largest to smallest possible size, there are sixty orders. That means, start with one cubic meter—about our size, then add thirty zeros, and you have the total visible size of the universe—from us to the very horizon of all things.

Now, however, there is another equal and almost inconceivable range of orders of magnitude in reverse, from us to the smallest possible measurement of size that delves deep within the remoteness of subatomic space; that's thirty orders of *negative* magnitude. We stand

equidistant between the outmost curtain of the cosmos and the inmost sanctum of the smallest thing imaginable. It's as vast down *in* as *out* there. It gives me vertigo!

What's important about our residence between the *outer* and *inner most* is this—if we were much smaller, we wouldn't be made of enough atoms to be complex enough to have our consciousness, and with it, the capacity to understand our place in the cosmos. If we were much bigger, the speed of communications among our parts (which is limited by the speed of light) would be too slow. The upshot is this: complex consciousness is the job of creatures about our size. And that means if we ever encounter intelligent aliens, they are going to take up about as much space as we do, if they exist. (Primack and Abrams, 156-76)

Now on to the fifth icon and a very speculative proposition. If modern theories are right, then beyond our unique and isolated universe that formed in the Big Bang (that's the circle there with us in the middle), there is an infinite multi-verse wherein every region is coming into being and racing away from each other at such speeds that nothing larger than an elementary particle can ever form (that's represented by the zigzag lines*). But here, inside our bubble, resides the rarest of phenomena: the evolution of a long-lived universe.* Here is time for our histories, time for us. There is space across which connections can be formed and structures can develop.

Theoretically, there may be a blizzard of universes in which ours is a single snowflake, one that crystallized at the outset into a unique pattern of matter and energy and set us off on a journey to realize itself as a universe. But unlike a blizzard of real snow, these universes don't pile up or ever land. Each one is isolated forever from all the others by more and more eternal inflation between them. The great miracle of our universe is that something is happening. Galaxies are evolving. Our life stories are playing out. We and our cosmic home are not just

eternal potential—we are a part of a great story that allows our home and creatures like us to exist. (Primack and Abrams, 181-205)

Sixth icon: where our planet (that's the dot) resides in the spiraling arms of our galaxy; a planet that formed about 4 ½ billion years ago and where *we live, more or less, at the midpoint of its history*. Now here comes a spoiler alert. In a couple of weeks, I'm going to talking about the end of the world. There's a lot of chatter out there about Mayan calendars coming to an end on December 21st and with it, the apocalyptic end of things. I don't think it's likely; not just yet, and not for quite some time.

In the meantime, let's appreciate the fact that our planet is welcoming place for life to exist. Our distance from the sun and our nearly circular orbit locates us firmly in a zone conducive for habitation; plate tectonics and surface water continually recycle carbon and other elements essential for life; our moon—due to its size and proximity—stabilizes the Earth's rotation and climate; and because we're located half-way out from the center of the Milky Way, and not subjected to dangerous levels of radiation that exist closer to our galaxy's center, our solar system resides in a galactic zone welcoming to life. In all these respects and more, ours has been a fortunate planet, and we're her lucky beneficiaries. (Primack and Abrams, 206-13)

Last icon, and we're in the home stretch. In 1886, Unitarian minister James Freeman Clarke stated that one of the five points of our theology was the belief in the "progress of mankind, onward and upward forever." It's kind of heart-breaking statement: innocent, tragic and dangerous all at the same time, at least reading it now. We saw world wars, cold wars, and now we're living in the midst of unprecedented income inequality and threats to the long-term viability of our environment. "Progress onward and upward" twisted into a nightmare neither dreamt nor ever intended by Rev. Clarke. I don't have to hammer this home, not here, not now.

Let me just say this: Earth is 4.5 billion years old; its future stretches out for billions more years. And although the sun is slowly getting hotter, it will provide Earth with a perfectly livable amount of heat and light for at least several hundred million years. (Primack and Abrams, 239) Though we should, that's not how we tend to think. The still-dominant Newtonian cosmology implies that we are of no particular significance in the universe. That's what Lucy was telling Snoopy last week. And it leads people as knowledgeable as Stephen Jay Gould and Joseph Campbell to say that humans "are merely a fortuitous afterthought," a flake "on the epidermis of a small planet of an average star." (quoted in Primack and Abrams, 273-4)

The problem with statements like this is that if we're of no real significance, what good can our actions really be in the big scheme of things? If some think the "end is near"—then, we embrace time-myopia for religious and me-first reasons. If we think the quarterly bottom line is the highest economic standard—then we embrace resource-myopia for financial reasons. If we think the next election is the be-all, end-all in the political cycle—then we embrace pursuit-of-power myopia for political reasons. All this for short term gain and long-term loss.

Our old, Newtonian cosmology has outlived its usefulness; it does not accurately explain our world. We need to ground ourselves in something real that is greater than we are, and *the new universe coming-into-view is as real and as important as anything can be*. We can either fail to rein in our rapidly expanding patterns of consumption and hit the brick wall coming at us; or begin now to *think cosmically and act globally*.

In the expanding universe, human beings are not only significant—we are central. Claiming centrality does not mean that the universe was created for our eventual arrival or evolved with us in mind. It did not. As well, *longing* to be central is not what *makes* us central. Psychologically, spiritually—our ancestors were right: human consciousness places us in the

center of reality. The new cosmology is telling us it's not an illusion. Any other description of reality that would rob us of that place, that fact, whether based on old-school science, philosophy, religion, you name it, contradicts this internal sense and our external reality. The only place human beings can ever feel like we belong to the universe is at the center. The new cosmos coming into view, one theory and observation at a time, reveals that we are at the center of the very *principles* and structures that uphold the universe. May we think, feel, and act as though it's true so that we may, after all, hand along a planet home worth living in for countless generations to come. That's my Advent message.