Finding a Home in the Cosmos

In a new book written with his wife, Nancy Abrams, cosmologist Joel Primack argues that the universe, far from being a meaningless void, was meant for us. Sort of **BY JERRY ADLER**

FOR THE PAST 400 YEARS, says cosmologist Joel Primack, the measure of intellectual sophistication about the universe was acceptance of our own planet's insignificance within it. The Earth, ousted by Copernicus from the center of the heavenly spheres and tamed in its motion by Newton's laws, had shrunk to a speck by the last century, lost in a universe that grew larger each time humans pointed a telescope at it. Most people who don't get their cosmology from the Bible have assimilated this idea into their worldview—which is why it's a little surprising that an impeccably credentialed scientist like Primack has written a book, with his wife, Nancy Ellen Abrams, called *The View From the Center of the Universe*. The center, they say, is right where you are.

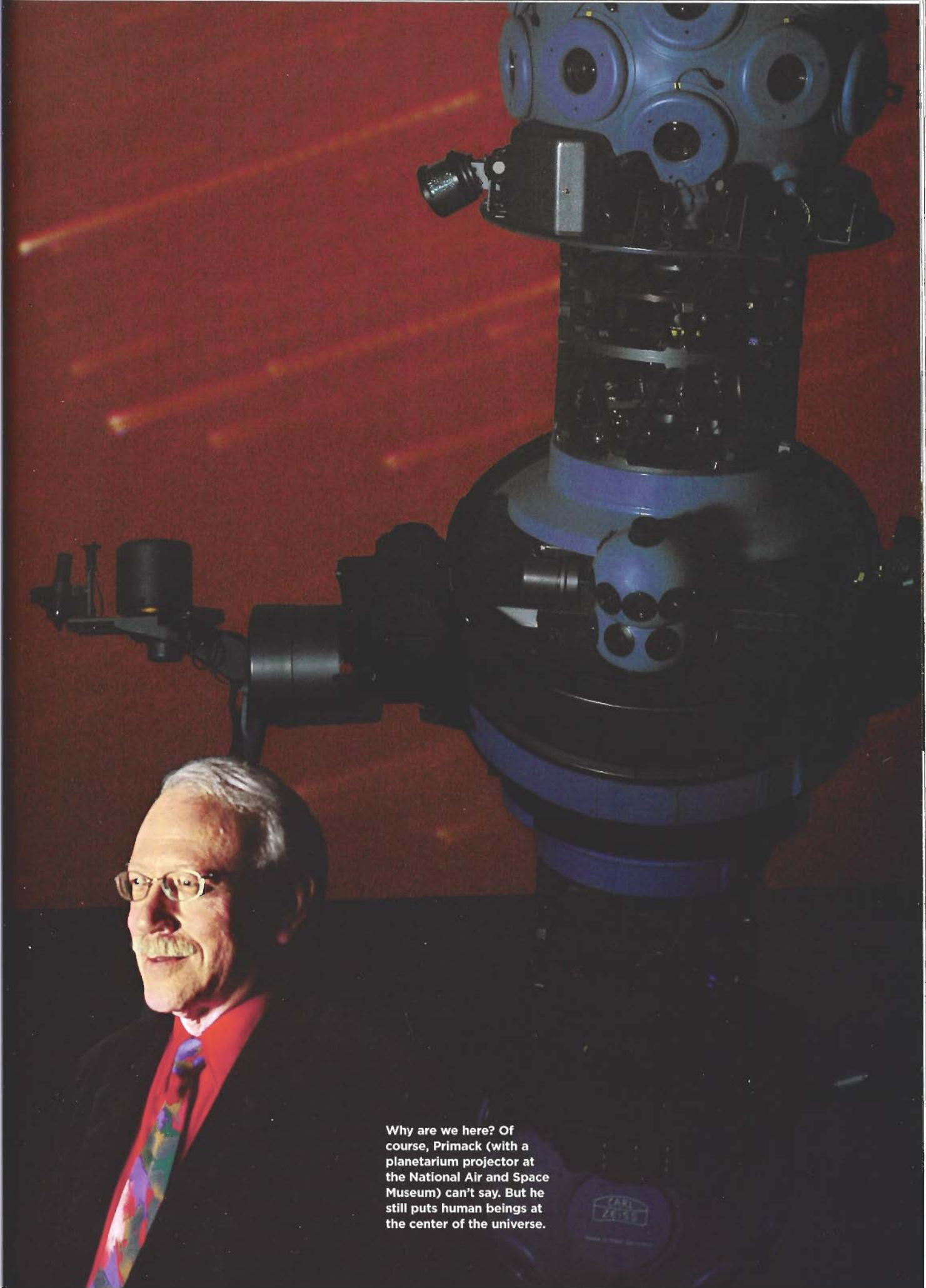
Primack, whose field, cosmology, lies at the intersection of particle physics and astronomy and is at the very margins of human comprehension, was one of the pioneers of the "cold dark matter" theory to account for the invisible mass whose gravity holds galaxies together. He is 60, trim, mild-mannered, with silvery hair and matching mustache. Raised largely in Southern California, he attended Princeton and Stanford before joining the faculty at the University of California at Santa Cruz, a campus in a hillside redwood grove. Abrams is a writer, musician and, by temperament, a philosopher, occupying a privileged position in a thrilling scientific dialogue about the nature of the universe *without having to learn integral calculus*. Slender, with a dark, piercing gaze, Abrams appears in the guise of a New Age priestess on the cover of her most recent CD, "Alien Wisdom," posed against a backdrop of stars, suspending the Earth between her outstretched hands.

Primack was a particle physicist who became interested in cosmology in the late 1970s, coinciding with the field's transformation by inflation theory and supersymmetry. The former is the idea that for a tiny fraction of a second at the beginning of the Big Bang the universe expanded faster than the speed of light, creating random energy fluctuations that eventually became the large-scale structures of galaxies, galaxy clusters and superclusters. The latter is a theory that relates the properties of particles of force and matter, giving rise to predictions about invisible, or "dark," matter. Primack has lived through, and participated in, what he considers one of the great achievements of human intellect: the unification of experiment, observation and theory in a mathematically consistent account of the 14-billion-year history of the universe. "There are still a lot of unsolved problems, but all the data fits together," Primack says. "We cosmologists have been congratulating ourselves that we finally got the story right. But that's something that the public doesn't appreciate."

If laypeople don't appreciate it, that's partly because unsolved problems still loom large. The nature of "dark matter," of which there seems to be vastly more than ordinary visible matter, is still conjecture. There is not even a

Primack has lived through, and participated in, what he considers one of the great achievements of the intellect.

P. 73 COMPOSITE PHOTOGRAPH BY WILLIAM COUPON



Why are we here? Of course, Primack (with a planetarium projector at the National Air and Space Museum) can't say. But he still puts human beings at the center of the universe.

convincing conjecture about the nature of "dark energy," which propels the ongoing expansion of space. But another reason for the incomprehension, Primack and Abrams believe, is that people who can't follow the math have no convenient way to think about these things—no way, that is, to relate these discoveries to the macroscopic, earthbound realm of human perception. *The View From the Center of the Universe*—a meditation on our place in a universe comprising a hundred billion galaxies of a hundred billion stars—is their attempt to fill that need.

The center of the universe is not, of course, a geometric point in space, but a metaphor for humanity's place in the cosmos. Consider, Primack and Abrams write, that the physical size of human beings is roughly midway on the logarithmic scale between the so-called Planck length—the smallest meaningful increment of distance, about 10 to the minus 33 centimeters, and the distance to the edge of the visible universe, the largest meaningful distance, about 10 to the 28 centimeters. Much smaller creatures than we are could not develop the complexity necessary for intelligence; much larger ones would be limited by the time it takes information to travel across their brains. Earth also happens to occupy a privileged niche of habitability—neither too close to the Sun nor too far, protected by Jupiter's gravity from collisions with comets, locked by the Moon into a stable orientation that provides predictable seasons. If our solar system were very much closer to the center of our galaxy, cosmic rays from nearby stars might have made life impossible; very much farther out on the edge, and the heavy elements that make up the Earth (and living creatures) might have been too sparse. And so on. There are two ways to respond to these observations: you can shrug and say, *so what? If any of those things were different, we wouldn't be here to notice anyway, so their apparently miraculous coincidence is an illusion.* Or you can find in them a source of wonder and inspiration. "There is no deeper source of meaning for human beings," Primack and Abrams write, "than to experience our own lives as reflecting the nature and origin of the universe."

Exactly what that meaning consists of is, however, "a tremendous open question," they say, something that can only be apprehended dimly, speculatively, metaphorically. They denounce what they call the existential, or nihilist, view of life as just a flicker of awareness in an indifferent universe. But in their effort to create a philosophy that draws on the entirety of space and time, Primack and Abrams quickly run up against the limits of what human beings can, even in principle, know. We may, as the authors say, be participants in a great cosmic story "as far beyond our imagination as that which atoms and cells are playing for us." But confined to our middling place in the range of possible size scales, how would we know? Primack and Abrams don't even speculate on what that cosmic drama might be. In the final chapter of their book they pose for themselves the straightforward question many readers will be asking: Do they believe in God? The answer takes up several dense paragraphs, ending in the assertion that they "believe in God as nothing less than the process of opening our personal lines of contact with the unknown potential of the universe"—a sentence that the word "unknown" transforms from merely insubstantial to, well, empty.

"Humans are not merely a random growth on the surface of a small planet of an average star," say Abrams and Primack (in their Santa Cruz, California home). Their book offers a nonsectarian blend of cosmology and philosophy.

BILL LOVEJOY / SANTA CRUZ SENTINEL

They denounce the existential, or nihilist, view of life as just a flicker of awareness in an indifferent universe.

So are they mystics, spiritualists, Buddhists? To be sure, Primack's work is as grounded in empirical results as theoretical physics can be. Physics informs even Abrams' songs, which are really more like poems set to music. Her CD track *The Handwriting of God* must be the only ballad ever composed about the cosmic background radiation from the Big Bang. In the couple's home, on a hillside overlooking Monterey Bay, there are several telescopes but no healing crystals or pyramids on view. They celebrate New Year's Day with a confection they call the Cosmic Dessert, symbolic of the distribution of mass energy in the universe: 70 percent chocolate cake, representing dark energy; 25 percent chocolate ice cream (for cold dark matter); and the rest other stuff, including a tiny pinch of cinnamon, which stands for the heavy elements forged in stars—in other words, most of what constitutes life. But on Friday nights Abrams lights candles and says a prayer in the ancient fashion of Jewish women since time immemorial. Not, Primack says, because they really believe anyone is listening. Then he catches himself and says: "I'm listening." ○

JERRY ADLER *is a senior editor at* Newsweek. *The photographer* **WILLIAM COUPON**, *making his first appearance in this magazine, is working on a book of his portraits.*