

Proposal for a book

The Meaningful Universe

Our Pivotal Place in the Cosmos

by Nancy Ellen Abrams and Joel R. Primack

Submitted by

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Overview: The Need for a New Cosmology

In their hearts, most educated people today are still living in a 17th century universe, where space is merely emptiness, the starry night extends indefinitely, and common sense is a reliable guide. When you close your eyes and try to picture the universe, do you see lonely asteroids, spiral galaxies, or the rising of an ember-red moon over an unknown planet? These scenes are suggestive of outer space, but they are no more representative of the universe itself than a single atom or your own face. The strange fact is that in this information age, fast-paced images are our currency of communication, yet we have no idea how to picture our universe

In anthropology the word “cosmology” means a culture’s shared picture of the larger cosmos in which life and nature make sense. Every prescientific culture had such a picture, and it defined reality for them. In earlier cultures, people told stories full of imagery, which created a picture in the mind of the origin of things and how humans fit in. For millennia, these stories provided models for human behavior, because living in harmony with the universe was the deepest spiritual goal. Today, however, “cosmology” also means the branch of astrophysics that studies the origin and nature of the universe as a whole. Although the two meanings of cosmology overlap, they are very different. Earlier cultures’ stories were not correct by modern scientific standards, but they offered guidance about how to live a life at home in their world. Modern scientific cosmology says nothing about human beings or how we should live. It wants to provide accuracy, not meaning. This book aims to bridge the two kinds of cosmology by offering the first science-based explanation of our place in the universe.

The last time Western culture shared a comforting, coherent picture of reality, in which everything including God had its place, was the Middle Ages, when Jews,

Christians, and Muslims all believed that the earth was the unmoving center of the universe and all the planets and stars revolved on crystal spheres around it. This was what might be called a *functional cosmology* because it made sense of the world people lived in, explaining the hierarchy from king to serf to lowly earthworm as the continuation of the hierarchy of the heavenly spheres. This order was the intention of God, who surrounded it all and whose love was the force that kept the spheres rotating. Galileo's telescope observations in the early 17th century undermined this stable, geocentric picture, and nothing has ever fully replaced it. Instead early science substituted a bleak suggestion of endless emptiness, randomly scattered with stars, and left succeeding generations with a sense of the universe as overwhelming and incomprehensible. This "Newtonian" picture of the cosmos was incomplete – it had inconsistencies, and there was no accounting for human beings. Until the late twentieth century there was virtually no scientifically reliable information about the history or structure of the universe as a whole.

Today scientific cosmology is in a Golden Age of discovery because of a combination of extraordinary new instruments and telescopes on the one hand and daring theoretical breakthroughs on the other. These breakthroughs have not only ruled out theories scientists once thought were right—the new data support fertile, counterintuitive directions of thinking that have so far passed all tests of consistency with our rapidly increasing knowledge. Scientific cosmology is now putting together humanity's first picture of the universe as a whole *that might actually be true*. Most people can barely appreciate how enormous this gift could be. Since early science destroyed the Medieval illusion of the music of the spheres, the West has visualized a cold universe in which humans are rootless and there is no believable explanation of how things got this way. In 1670 Blaise Pascal described a sense of cosmic malaise

unknown in Medieval literature: “I feel engulfed in the infinite immensity of spaces whereof I know nothing and which know nothing of me. I am terrified...The eternal silence of these infinite spaces alarms me.”

The new cosmology is complex and even bizarre but also breath-taking and inspiring. The universe is not just vast – it exists on every size scale down to the very smallest and includes all time. In it humans are neither incidental nor insignificant but instead are central in unexpected ways that could not have been imagined without radical new concepts. In this book we present these concepts verbally and visually, using simple explanations, and demonstrating how these new concepts may expand our way of thinking and help us solve perennial problems on planet earth.

A coherent picture of the universe is at last possible, but the catch is that unlike earlier cosmologies it is not intuitively simple. It cannot be, because our intuition always makes the assumption that we’re on earth. But on both larger and smaller size scales, the universe is nothing like the earth. Cosmology challenges our intuition.

The famous photograph of the earth taken from the first Apollo spacecraft to orbit the moon shows a sparkling blue and white ball, suspended in blackness with a sterile lunar landscape in the foreground. This photo jolted many people into realizing what of course they knew intellectually: that maps and globes have imprinted a wrong picture of reality on our minds—there are no countries on this planet. There are only land masses, oceans, and clouds. This modern icon of our gorgeous, undivided home planet, spaceship earth, shows the power of a new image to alter perceptions and even attitudes. In this book we begin the process of portraying the universe in similarly meaningful pictures.

Visualizing the Expanding Universe

Our book will present cutting edge scientific cosmology in the form taken by all successful traditional cosmologies – pictures. But we use the word “picture” metaphorically. No visual image like the photo of earth can actually convey the “real universe” because there is no way to get outside the universe to see it; there is no moment in which a snapshot can be taken, since the universe includes all time; and most of the matter in the universe is invisible. While we can’t see the universe itself, we can, like many earlier peoples, use symbols to visualize our understanding of the cosmos. A symbol is the most compact, effective package of information humans have ever invented. It goes from the eyes straight to the heart and mind simultaneously. Most of the images we use are based on ancient symbols, which we have selected because they resonate with a modern concept. We then re-interpret these symbolic images to represent what we now know about the universe in a way that revitalizes their ancient meanings, so that these symbols can convey deeper truths about the expanding universe and our place in it than a linear explanation alone could. A symbol is far easier to hold onto than a long, logical argument or a mathematical equation. The symbols that we have chosen have deep and rich associations in our cultural memory. They succeeded in making people feel connected to invisible reality.

While science has been primarily concerned with discovery, we humans are meaning-makers and we need some understanding of the significance of new knowledge and some way of ordering the flood of facts. Modern cosmology offers concepts which, understood as metaphors, suggest radical ways of thinking about all mystery beyond our experience. What matters about the universe as a whole to the

non-expert today is not technical details but an understanding of the fathomless reality that scientific cosmology is opening to us. This awareness can change a life. It can change life. *The Meaningful Universe* uses rigorous modern science to help illuminate the universe for all of us who seek meaning in our lives. This meaning-making is not itself science, but perhaps it is the point of science.

Ultimately this is *our* universe, our home, and every one of us is intriguingly connected even to the aspects of it that seem most strange. If we want to understand the context in which our lives and planetary history unfold – our larger identity – we need cosmology. If there is ever to be a truly useful modern cosmology, it needs, like every functional cosmology of the past, to embody the truest picture available, according to the highest standards of its time. These standards are now irreversibly scientific. But no scientific story of the universe, however accurate and sweeping, will be enough by itself to affect anyone's behavior or outlook. Human beings need to *feel at home* in their universe, and the key to this is not only to learn the new story and understand the new picture but to embrace them as long-lost family. This could transform scientific cosmology into a functional cosmology, in which there is meaning and a place for human beings. We think that this symbolic portrayal of the universe will once again make it possible to satisfy the ancient human longing to experience a personal connection to the universe.

The Book

The Introduction explains what a “picture of the universe” is, why humans suffer without a believable one, why in the age of science no picture can work that is not grounded in science and why, because we are in the midst of a fundamental scientific revolution in cosmology, we are on the verge of having the first picture of the universe in human history that is verifiable – and that may actually be true.

Part I “Speculative Facts and Believable Fictions” explores what scientific cosmology is and how scientific “truth” evolves compared to cosmologies of the past. Chapter 1 “The Cosmological Revolution” explains how the scientific revolution currently taking place is not just proposing another set of speculative theories but is creating the foundational theory of the field of cosmology. It is likely to remain true forever, although it will inevitably be modified and encompassed by wider theories in the future, as happened when Newtonian physics was encompassed by Einsteinian relativity. Chapter 2 “What is a Picture of the Universe?” explores representative cosmologies of the past, including the Biblical and Medieval cosmologies, and what these stories meant to the cultures that created them.

Part II “Picturing the Expanding Universe” lays out what the modern picture is, and what the big concepts are that a reader needs in order to grasp it. This is the part that is presented through images. Here we tackle the main cosmological questions: “What is the universe made of?” “Where is the center of the universe?” “How big is the universe?” “Where did we come from?” “Are we alone?”

Part III proposes the possibility of using these ideas to enlarge our thinking, to envision new solutions to earth’s seemingly intractable problems, and to allow a realistic expansion of our own sense of identity.

We envision the book as a 200-300-page standard trade format book that we will deliver a year to eighteen months after contract. The book is being written for a truly popular readership, and, given our desire to reach a wide range of scientifically and spiritually curious readers, the text will be as free of jargon as possible and completely free of equations. Our assumption is that the book must be readable and enjoyable by intelligent readers who know nothing about cosmology and very little about science. We have tested and honed our ideas for six years against the most skeptical critics, the college students in our University of California course, “Cosmology and Culture.”

Our book uses images to show readers how to grasp the modern universe and let this imagery expand their imaginations. It is the first book ever to portray the universe this way. Theoretical physicists actually think pictorially, yet when they write scientific articles and even popular books, they tend to rely on long logical arguments, which bore most people. Ultimately, if we can’t visualize the universe, we can’t think about it.

In addition to these images we also include guided visual meditations, which we call *contemplations*. A contemplation walks the reader through a possible intuitive experience of the image. Using these contemplations in university classes and public talks, we have found that once the content of a symbol is understood, contemplation helps the idea within it penetrate to a deeper level. It is easier to master most cosmological ideas intellectually than to open up to them emotionally. But it is impossible to appreciate what they may be telling us as human beings unless we embrace them in this deeper way. It is this appeal to the integrated heart and mind that can lead, we hope, to a meaningful cosmology for our time.

We believe we are the first to link modern cosmology to its possible political implications. The two of us have long experience in political affairs and sensitivity to the political implications of our work. Joel started the AAAS Congressional Science Fellows Program and the AAAS Science and Human Rights program, as well as the American Physical Society program of critical studies of technologies such as reactor safety and missile defense. He has served on many advisory panels, co-authored a prize-winning book about science in the political arena, and is a leader in the fight to protect the space environment. Nancy worked in the former science advisory office of the US Congress, the Office of Technology Assessment, invented Scientific Mediation (a method for handling controversial science policy issues), and has written numerous articles on science, politics, and ethics, not to mention an album of songs of political satire. The political impact of this book could be substantial. Anyone who appreciates the ideas in it will come to see the earth in a new light.

We do not assume this book will be the last word on the subject, nor is the responsibility ours – or anyone’s – of coming up with a new cosmology that serves everyone. Instead we hope this book will inspire a cross-cultural and cross-disciplinary interplay of ideas. If so, it will take the first step toward the creation of a new story that places humans where we truly are in the universe and directs the power of this knowledge toward the benefit of our planet as a whole.

Author Bios

Joel R. Primack and Nancy Ellen Abrams are married and have unusually complementary viewpoints. Joel R. Primack is one of the world’s leading cosmologists. He publishes more than a dozen scientific papers a year and is one of

the most cited and influential researchers in the field. Nancy Ellen Abrams is a philosopher of science, writer, artist, and lawyer, who has for over two decades closely followed Joel's work, attended countless astrophysics conferences, and met and talked with many people in the field. Together they have developed and taught a prize-winning course at the University of California, Santa Cruz, called Cosmology and Culture .