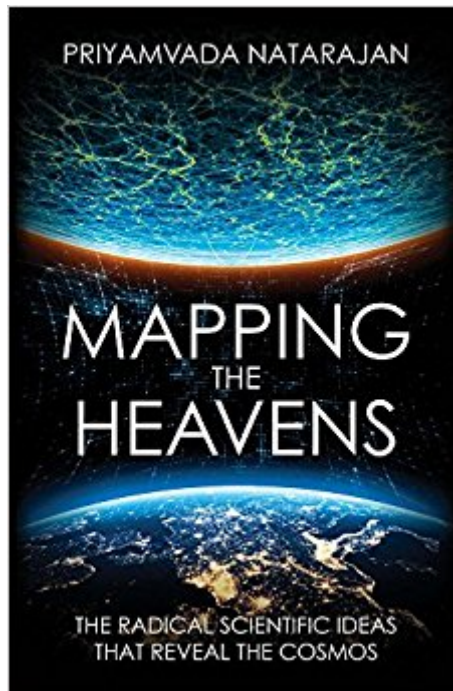


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# Mapping The Heavens: The Radical Scientific Ideas That Reveal The Cosmos



## Synopsis

For all curious readers, a lively introduction to radical ideas and discoveries that are transforming our knowledge of the universe. This book provides a tour of the "greatest hits" of cosmological discoveries—the ideas that reshaped our universe over the past century. The cosmos, once understood as a stagnant place, filled with the ordinary, is now a universe that is expanding at an accelerating pace, propelled by dark energy and structured by dark matter. Priyamvada Natarajan, our guide to these ideas, is someone at the forefront of the research—an astrophysicist who literally creates maps of invisible matter in the universe. She not only explains for a wide audience the science behind these essential ideas but also provides an understanding of how radical scientific theories gain acceptance. The formation and growth of black holes, dark matter halos, the accelerating expansion of the universe, the echo of the big bang, the discovery of exoplanets, and the possibility of other universes—these are some of the puzzling cosmological topics of the early twenty-first century. Natarajan discusses why the acceptance of new ideas about the universe and our place in it has never been linear and always contested even within the scientific community. And she affirms that, shifting and incomplete as science always must be, it offers the best path we have toward making sense of our wondrous, mysterious universe.

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## Customer Reviews

This book is a crystal clear account of some of the most amazing insights we have obtained into the workings of the universe and the brilliant minds who helped us gain these insights. The topics range

from Copernicus's model of the solar system to the latest models of the Big Bang. The author Priyamvada Natarajan who is a professor at Yale writes authoritatively and simply, and her infectious enthusiasm for science comes across. The book mainly shines in three ways. Firstly, it does a great job explaining the details of the science. The book starts with an account of Copernicus and Ptolemy's models of the solar system and lays out the evidence which led Copernicus and later Kepler to come up with valid frameworks within which to understand the motion of the sun, the earth and the stars. Later chapters talk about relativity, dark matter, the Big Bang and black holes and finally describe the most cutting edge science involving amazingly precise measurements of the first few microseconds after the Big Bang. In every case the evidence and logic leading to a discovery are described in simple and enthusiastic language. Also included are engaging discussions of the various ways in which we can "see" the universe (visible light, x-rays, gamma rays etc.) as well as important topics like the synthesis of elements in the stars, exoplanets, the recent discovery of gravitational waves and speculations on the ultimate fate of the universe. Secondly, the book gives due credit not just to the science but to the engineering efforts that have allowed us to make sense of our cosmos. Thus there are ample references to radio and x-ray telescopes, spectroscopes and cosmic ray detectors and the new upcoming James Webb telescope. The author makes it clear that revolutionary science involves not just creative theoretical leaps but accomplished experimental craftsmanship. Sometimes theory lags behind experiment and sometimes it's the other way around, but the two are inseparable. Lastly the author is very good at recreating the human drama behind the discoveries. Brilliant scientists like Gamow, Slipher, Leavitt, Hubble, Rubin and Einstein get their dues, and their major work is highlighted. This part of the book shows us that far from being an idealized, linear endeavor, science is full of quirks, missed opportunities, half-baked theories and messy false alarms. In short science is human, and without all the attendant folly and triumphs inherent in human nature, we could not have known what we do about our wonderful universe. In short this is a very clear and engaging introduction to some of the greatest discoveries in astronomy and astrophysics. It should be of interest to readers of all ages, from aspiring high school students to adults wanting to catch up on the history and future of the field. Strongly recommended for school and public libraries.

This is a book covering the *new* discoveries in cosmology. These are the expanding universe, black holes, dark matter, dark energy, and the cosmic background radiation. The Big Bang Theory enters many of these discussions as well. I placed the word new in quotes as most have histories that go back almost 10 decades, and there are many books on these topics already

in print. Brian Greene's books come to mind. On the other hand, having concise coverage of these topics is certainly convenient. But I have to give a mixed review as the writing has many up-and-downs. The first chapters seem to be abstracted from classroom lectures for non-scientists and the writing is choppy. For example, in the chapter on the expanding universe, Edwin Hubble's findings are revealed and the controversy described. Only later do we find out Hubble's methods and data. Since this work is roughly 100 years old, the findings are certainly not a surprise. But the discussion of the methods reveals some things not well covered elsewhere. The problem of measuring stellar distances is the start of the matter. Cepheid variables and Type 1A supernova are the usual standard candles. Hubble's use of type O and B stars as standard candles is something I had not known. These distances paired with red-shift data are the basis of Hubble's Law. But curiously, red-shift gets minimal mention in this chapter, with far more coverage in the black Holes chapter. Of course this highlights the interconnectedness of all these topics and no single chapter stands alone. The writing gets better as the book progresses and the later chapters, in which the author is a subject expert, are indeed quite good. The historical coverage flows on a smooth timeline and is very interesting. While many books cover the facts of the new cosmology, this book reveals much of the controversy, politics and personalities of the scientist involved. I was particularly impressed with the author's high regard and revealing discussion of Ralph Alpher's contributions to science. This type of content is harder to come by and is the most valuable aspect of the book, at least to me. Some of the illustrations in the book are above the technical level of the writing. Hubble's graphs are shown, but not the Hubble's Law equation. The Drake equation is described but not shown. I would suggest that such simple equations are certainly understandable at this level. The author ventures into the differences between physicists and biologists, their philosophy on the importance of mankind, and the anthropic principle. As a biologist, I was quite taken aback by some of the comments. But also having a degree in physics, I have to say that most of the controversy on this topic arises from physicists misunderstanding biology, and not vice versa. The topic is too broad, has too many forms, too mixed up in religion, and not well served by the brief coverage in the book. This review is based on a pre-release copy. Several of the chapters contain pages marked "short" at the bottom suggesting they are not yet complete or final. Some of my comments may not apply to the published edition. There is one factual mistake in chapter 6, "The Next wrinkle". Lithium is said to be the seventh element in the periodic table; it is the third. I believe this is the author's first book written for the "secular" audience, at least the only one discoverable on . I hope not the last...

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