

Our Universe

The Universe in which we live is unimaginably vast and ancient, with countless star-systems, galaxies and extraordinary phenomena as strange and different from each other as black holes, dark-matter, quasars, gamma-ray bursts and diffuse nearly-invisible galaxies. From our earliest days humankind has looked to the heavens and wondered in awe.

Our Universe is a fascinating collection of essays on extragalactic astronomy and cosmology at the dawn of the twenty-first century. This is the second in a series of extraordinary books in which S. Alan Stern has brought together leading space scientists to describe their work. The first of these, *Our Worlds*, looked at the faraway worlds of our solar system, but in this new book we leave our sun behind to explore the vastness of the Universe itself.

This accessible and wonderfully illustrated book has been written by some of the world's foremost astrophysicists. Some are theorists, some computational modellers, some observers, but all provide deep insight into the most cutting-edge, difficult, and bizarre topics of all astrophysics.

Once again, highly personal accounts reveal much more than the wonders and achievements of modern astronomy, more than just its techniques and state of knowledge. *Our Universe* also gives unique perspectives on what drives these extraordinary, talented scientists and how their careers and very lives have been shaped by a burning desire to understand our Universe.

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Frontmatter

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*To my parents and their generation,
for opening the door*

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Contents

Preface ALAN STERN vii

The frontier Universe: At the edge of the night ALAN STERN 1

Part I: Revealing a Universe 5

1 Mapmaker, mapmaker make me a map

Probing the Universe's large-scale structure 7

JOHN HUCHRA

2 Looking back in time: Searching for the most distant galaxies 23

ESTHER HU

3 So we've lost the mission? The Big Bang and the Cosmic Background Explorer 37

JOHN MATHER

4 Computational adventures in cosmology 55

NICK GNEDIN

Part II: Denizens of the deep 71

5 The search for very massive black holes 73

DOUG RICHSTONE

6 Gamma-ray bursts—the most spectacular fireworks 89

BOHDAN PACZYŃSKI

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Frontmatter

[More information](#)

Contents

7 Clusters of galaxies and the fate of the Universe (Or how to be a cosmologist without really trying) 107

MEGAN DONAHUE

8 Dark matter and the discovery of galactic halos 127

JEREMIAH OSTRIKER

9 Hunting the elusive invisible galaxy 135

GREGORY BOTHUN

Color sections facing pp. 56 and 88

Preface

Modern human civilization now stretches back almost 300 generations to the earliest organized cities. For most of that time, each clutch of humans identified their settlement and its surrounds as their home. Less than 100 generations ago, information transmission and transportation technologies were capable enough for people to form nation-states consisting of many cities and villages and consider them as a new kind of “home.” In the last two generations—with the advent of space travel—many people have come to see their “home” as the whole of the Earth. This is an idea that would have been unthinkable to the ancients—for the world was too large for their technology to integrate the world, or even a nation-state, into an accessible and cohesive community.

So too, though it may not be hard in the future, it is hard for us, now, to think of our “home” as being something larger than our planet. After all, we are still trapped, both physically and to a very great degree intellectually, on our wonderful home, this planet, Earth. A century ago, Konstantine Tsiolkovsky, the great Russian space visionary, described the Earth as the cradle of mankind, saying that humankind, like any infant, cannot live in its cradle forever.

For perhaps at best a few thousand humans (about one in every 10 million), those who are planetary scientists, astrophysicists, extragalactic astronomers, and cosmologists, this vision of the Earth as a cradle

Preface

from which we peer outward to learn about a larger realm is already becoming a familiar and natural concept. And it is this concept, in part, that gave birth to the idea in 1996 to bring together a few of the very best planetary scientists in the world to write about their favorite worlds, and in doing so to give a little perspective on what makes both them, and their favorite places, tick. That effort culminated in the publication of a book of essays about planetary science by planetary scientists. The book, called *Our Worlds*, was published by Cambridge University Press in 1998. On the heels of that volume, I wanted also to tell some stories of extragalactic and cosmological exploration through the eyes of the scientists who are charting that vast and deep ocean of space and time.

And so, with the blessing of Simon Mitton, the director of astronomical publications at Cambridge University Press, I set out in late 1998 to contact some well-known stars among the firmament of astronomical researchers, and asked each to tell a personal story involving their own career and motivations, and to describe some part of a favorite topic in which they had invested long years exploring. I asked each to tell their story from the heart.

What follows in this volume is a set of nine wonderful and diverse essays ranging across the breadth of extragalactic astronomy. The stories in this book, *Our Universe*, range from giant lurking galaxies so diffuse they were hardly known until recent years, to the fireball of the Big Bang, to the hearts of black holes. Within this book you will find both a lot of modern astrophysical science, and an insider's perspective about how turn-of-the-century astrophysics is done. You will also see a good deal of what drives and interests lifelong astronomers and, on occasion, you will learn something about their inner hopes and aspirations.

So, come and listen to some personal tales of human exploration, high-tech gadgetry, and the thrill of being a detective to the Universe. Come and visit *Our Universe*.

Alan Stern

November, 1999