On the Cosmic Horizon

Ten Great Mysteries for Third Millennium Astronomy

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This book is dedicated to Grant and all the other children who will grow up in the third millennium of the Gregorian calendar. May it be an age of enlightenment, free from the darkness that plagued millennia past.

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Preface

Outside of religion, no human pursuit deals with deeper questions of our existence than astronomy. Thus it is no wonder that astronomy has long captured the public imagination. Stories of astronomical discovery often make the headlines, and astronomical images and ideas infuse many aspects of our culture. Today, however, the pace of astronomical discovery is so rapid that even professional astronomers sometimes have difficulty staying current. For everyone else, it's hard just to keep track of what professional astronomers are looking for, let alone to understand what they find. That's probably why friends and acquaintances who know me as an astronomer often ask, "What are the big questions in astronomy today?"

This book is my answer. Its primary purpose is to help you understand and enjoy the stories that are likely to dominate the astronomical headlines over the next decade or more. The book is designed to be accessible to anyone with an interest in the great mysteries of our universe, regardless of whether you've studied much astronomy before. As you'll see if you flip through the pages, it takes the form of a Top 10 List of cosmological questions that I call "mysteries for third millennium astronomy" to emphasize that they will be among the most active topics of research in coming decades. I've deliberately avoided questions that most astronomers consider settled, as well as questions that are unlikely to be answered in the near term (such as why the universe exists). In essence, the list is my personal guess as to which questions will appear most often in news reports of the early twenty-first century. There will undoubtedly be new and surprising discoveries that I have not anticipated and great progress in topics that I did not include in the top 10. And, of course, I apologize in advance to those astronomer friends whose favorite mystery didn't make my list.

In writing this book, I've tried to make the ten mysteries as independent and self-contained as possible, so you can skip around and read them in any order. At the same time, however, each of the mysteries introduces a few fundamental astronomical concepts, and I've tried to put these in an order that will enable you to build your understanding gradually. Thus, if you read the book straight through, by the end you'll have the beginnings of a solid background in modern astronomy.

So I invite you now to join in the human adventure of astronomical discovery. As you will see, we are on the verge not only of great new discoveries in science but of discoveries that may change the very way we look at ourselves as individuals and as a species. Happy reading.

Boulder, Colorado August 2000