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Jean Heidmann
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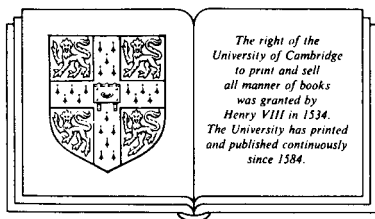
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Preface

The universe is a huge place. Three objects in the night sky, visible to the naked eye, can give us some impression of the dizzying depths of space. These three objects, the Moon, the Pole Star and the Andromeda galaxy belong respectively to the planetary, stellar and extragalactic domains. Light, travelling at 300,000 kilometres (186,000 miles) per second, takes one and a quarter seconds to reach us from the Moon, six hundred years from the Pole Star, and two million years to journey from the Andromeda Galaxy.

The universe is also ancient. Its past history is a series of overlapping epochs. Just a few thousand years encompass the historic past, and a few million take us back to the dawn of prehistory. Geologic history extends a few billion years into the past, whereas the cosmological history of the universe, takes us back fifteen billion years to the Big Bang itself.

The universe is full of delights. There are spiral galaxies and gaseous nebulas, faintly glowing mists set against the backdrop of deep space, multiple stars spewing out fantastic arcs of matter, and the fabulous landscapes of planets and their satellites. Humans have walked on the nearest object, the Moon. It always fills me with amazement when I see it in the early evening, between the first quarter and Full Moon,

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dominating the clear sky, as dusk begins. Reflected sunlight thus impressively shows us that the Moon is a globe. We can see dark plains splashed across the Moon's face, and at the jagged left hand boundary of the gibbous Moon, mountains are just discernible. And we can add to this beauty the astonishing knowledge that the mass of this globe has described a precise and regular orbit around the Earth for four billion years.

The universe is full of mystery. Why does another world accompany our own in its journey through space? What is the purpose of these worlds lost in immense, perhaps infinite, space? Why is space curved and linked to time in the four dimensions of spacetime? What of life, intelligence, and self-awareness, the consequence of life here on Earth? And is there perhaps extraterrestrial intelligence, on other worlds, in a more highly evolved form than here...

The universe is complex. Ever more sophisticated instruments reveal complicated physical processes, bringing renewed challenges for ever more elaborate theories: relativity, quantum mechanics, and grand unification.

The universe is our home. Our destiny and its fate are linked in a fundamental symbiosis. We are dependent on physical processes on scales running from organic molecules through to clusters of galaxies. We depend right now on the rules governing those processes, and from the remote past on the evolution they have experienced. We are even linked to the sub-structure of the elementary particles of matter, which in the last analysis govern physical processes. What are we? We are like the foam on a raging sea.

As humans we want to know where we are and where we are going. We want to understand the destiny that awaits the human race. That destiny intersects with that of the cosmos in which we are immersed, body and soul, and of which we are made. Humans want to understand these things in order to experience the beauty and joy of life to the fullest, and to benefit from the highest intellectual achievements.

The purpose of this book is to give a description of the fabulous richness of the cosmos, and to give as clear a picture as possible of the real nature of our incredible universe. After a

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first look at the starry night sky, I review the enigmas posed since ancient times by the universe. Then I give a broad brush view of the universe as we understand it today. Following this, a trio of chapters take us to ultimate questions about its nature; we explore in turn the relativistic universe, the quantum universe and the inflationary universe.

Finally I return to questions that touch on our own presence in the universe.