

Preface

My father was a forester and spent much of his life immersed in nature from sunrise to sunset. During the school holidays I would join him as he worked tirelessly and thought constantly. He instilled in me his love of the natural world and his wonder in its origins. What are all those ants thinking? How do trees defy gravity and suck water from their roots into such high canopies? Why does the Earth spin and orbit the Sun like some kind of mechanised clock? What is the nature of light? Can black holes really exist? Are we alone in this vast universe or is it filled with life?

This book is written in the memory of my father, who encouraged me to go to university to find some of the answers to the questions we discussed. It is for anyone who wonders about the world around them and who is interested in its origins. It is for my children to read, to inspire them in the same way as my father inspired me. It is something I would like to leave behind in this short but incredible life.

I want to tell the story of the history and future of life and the universe at a level that anybody who is interested in it can understand and enjoy. I will start at the beginning and end at the end, describing our place in time and space, how we got here and where we are going. I will take you on a journey from the beginning of time to the end of the universe to uncover our origins and glimpse at our destiny.

It is a journey of science fiction proportions but based on 3,000 years of scientific findings. I will explain how we acquired this knowledge, beginning with the ancient Greeks who pioneered the art of scientific investigation. This takes us on a remarkable path of discovery from the origin of atoms to dark matter and dark energy, from ants and elephants to space travel and life beyond our solar system.

The following is a true story based on actual events that took place. It's a good time to tell it, since in the last decade astrophysicists have collected new observational data that allow us to understand in detail the history of our universe and how all of its contents emerged. I have spent the last 25 years carrying out research on many of these topics and I would like to explain to you all of these developments using simple and friendly non-technical language. You may encounter some concepts that are difficult to understand—don't worry, some are rather tricky to explain. There is still a lot to learn and in Chap. 10 I will be honest about what we don't understand.

I have always been curious as to the lack of evidence for intelligent life elsewhere in the cosmos. There seems to be nothing special about our star, the Sun. There are billions of similar stars within the Milky Way, itself one of countless other galaxies. The goal of one of our most exciting research projects is to understand the origin of planetary systems and to determine whether habitable planets are abundant or rare. Our supercomputer simulations predicted that 'Earth-like' planets around stars similar to the Sun should indeed be very common. In the past few years very exciting observations have emerged from the Kepler space satellite that is discovering vast numbers of distant new worlds. I wonder how many of these have atmospheres and climates suitable for the emergence of life? How many of those worlds have civilisations more advanced than our own and have already begun to explore the galaxy?

Elephants are amongst the most intelligent creatures on Earth. They love, they mourn, they are social and fun, and their brains have a larger computational capacity than does the human brain. Without our Moon, life on Earth might have evolved rather differently, and elephants not at all; I will explain why later. I have recently given many popular and research talks entitled 'The frequency of elephants in the galaxy' which tie together all of these topics. Our latest research suggests that our galaxy alone hosts at least a billion planetary systems suitable for the development of intelligent life. I suspect that there are many other planets with wonderful thinking creatures like elephants; we just haven't looked in the right way or in the right places.

Our Earth has made over four and a half billion orbits around the Sun. If we can avoid self-extinction and collisions with giant asteroids, we can survive literally for billions of years as a species. Indeed, whilst humans have developed the frightening capability to cause mass extinction events, the same technology will be necessary to protect our planet from the inevitable impact of a rogue asteroid. Such random catastrophic events are rather like the random walks that our lives seem to follow—a journey during which apparently haphazard occurrences can dramatically alter our path. Just spend a few moments in contemplation after reading these words, and the future of your life could be very different.

Our brief time of consciousness is very special, but ultimately, we face the realisation that nothing lasts forever. The most recent observations from our great observatories, together with the theoretical work of my cosmologist colleagues, enable me to discuss the future of the universe. As time ticks on, and the stars begin to fade away and stop shining, can life continue for eternity or will the future be eternally dark? And what is the purpose of it all anyway?!

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<http://www.springer.com/978-3-319-05671-5>

Elephants in Space

The Past, Present and Future of Life and the Universe

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2014, XI, 189 p. 13 illus., Softcover

ISBN: 978-3-319-05671-5