Preface – a note to the reader

This book is about how the universe got from *there* to *here*, from the very first moments after the big bang to the present time. This preface briefly outlines how I got to *here*, and how this book got written.

After a somewhat unsettled time as an undergraduate, in which I nearly dropped out of university and turned my back on science, I gained a modest first degree, and was fortunate to be accepted to do a Ph.D. After that I worked for several years in England as a university post-doctoral researcher, and published a handful of specialist papers. I was enjoying finding out how the physical world works, but I was only dealing with selected bits of it in specialised areas. I realised that I wanted to share my knowledge, understanding and enthusiasm on a broader basis, and so I left university research and worked for 20 years in an 11-18 secondary school, where I became Head of the Science department, and gained accreditation as an Advanced Skills Teacher.

My subject specialism was Physics, but I taught all the sciences, and electronics, to all years. So, for example, I would teach the first ideas of chemical reactions to 12-year-old students through rôle play, with the students playing the parts of the reacting atoms; I taught genetics and the Big Bang theory of the expanding universe to 16-year-olds; and I introduced the quantum mechanics of particle-waves to 18-year-olds. Sometimes I taught all these within the same week.

This started me wondering how all these different aspects of the physical universe fitted together, because if our universe has evolved from a unique big bang event, then they must all be part of a unified, connected story – an unbroken narrative.

We're familiar with the idea that all living things are connected through the genes in their DNA, in an unbroken chain, to the very first biological ancestor. Similarly, every particle in our bodies and our physical world is connected in an unbroken chain of transformations to the very first particles created in the universe. If you could have marked a handful of fundamental particles in the very early universe, and followed them as the universe evolved, then you would see them now in various places – in deep space, in stars, in planets and in ourselves.

So, how did we get from *there* to *here*? By what processes have self-awareness, wonder and laughter emerged out of fundamental particles and forces and energy?

I had discovered that teaching science greatly improved my own understanding of the subject. It seemed that the best way – perhaps the only way – to understand something fully is to explain it for someone else. So, I decided that I would write my own account of the universal story, and I started on this in 2005 when I retired from teaching, with the distant idea that it might turn into a book. At first the account was just a narrative, a series of unconnected sections joined by "and then..." links, with no overall structure. Then, some time in the autumn of 2011, I realised that the whole scheme fitted a simple hierarchical pattern, and this is the basis of "The Communal Universe". I have spent the time since then working through the details, and shaping a rough draft into a book that is as "reader-friendly" as I can make it.

The remit is very broad, taking in disciplines such as particle and atomic physics, chemistry, biochemistry, cell biology, neuroscience, primatology, and anthropology. I have no particular expertise or authority in any of these specialist fields. I am a literate practical scientist with a basic understanding of a fairly broad range of scientific disciplines, a big collection of second-hand books and downloaded research papers, and a tendency to ask "How does that work?".

I have tried to write this book to be accessible to a general reader with a reasonable scientific education, say, a good pass in science at 16+ level. The reader needs only to be comfortable with simple formulas of the type $a = b \times c$, and with simple graphs, basic scientific units and standard form for handling large and small numbers, for example, giving the speed of light as 3×10^8 m/s.

There are some things this book is not. While I have drawn wholly on established and authoritative science from all disciplines, this book is not a review or a summary of our knowledge in each discipline. Also, I have based the book on well-established science, and avoided "cutting edge" science which may be controversial. And in cases like the evolution of humans and of language, it is impossible to say what actually happened, and instead I use established knowledge to lay out a series of steps whereby things might have happened – a viable series of stepping stones that got us from *there* to *here*.

What I write here is what I have learned from books and papers by people who are established authorities. So, as far as possible, every statement is supported by a reference, with maybe some further explanation, for anyone interested to follow it up. To avoid cluttering up the text, I have gathered together all the notes and references at the end of the book.

In this book, I will take you on a journey through our physical universe, from its beginning, with the simplest fundamental things, to the present time, with the most complex things. You will see how the universe is incessantly active, how nothing is ever still. Everything is on the move, interacting with other things, creating and sustaining communities. Finally, you will see how the entirety of our universe, the vast rich complexity of it all, fits into a simple scheme of a hierarchy of communities. Every "thing" in the universe is in fact a community of things, which are working together, and at every level a community is greater than the sum of its separate parts.

It is through forming communities that the universe, with us now in it, got from *there* to *here*.

Notes

"**We're familiar with the idea**": Dawkins 2004:7.

"**If you could have marked a handful of fundamental particles**": see Krauss (2002) on oxygen and Primo Levi (1986) on carbon.

"**The reader needs only to be comfortable**", the formula, $a = b \times c$, expresses the relationship between the quantities *a*, *b* and *c*, and if *a* is held constant, then *b* and *c* are inversely proportional, that is, if *b* doubles then *c* halves. Standard form is invaluable for handling large and small numbers. So, the age of the universe is about 14 billion years, or 14×10^9 y, and the width of a human hair is about 50 millionths of a metre, or 50×10^{-6} m, or 50 micrometres (50 µm).

I take heart from Harald Fritzsch's confidence that "*anyone with an elementary knowledge of physics can comprehend what physicists have accomplished in the last thirty years. ... What can be daunting, admittedly, is the sheer newness or unfamiliarity of the concepts and processes. But once having grown accustomed to them, the reader will realise that physics, if not precisely commonsensical in all respects, is fundamentally simple, orderly and comprehensible*" (Fritzsch 1992:13).

"**So, as far as possible, every statement is supported by a reference**", all references are to books or papers by established authorities in their specialisms. I have made very few references to Wikipedia, even though the accuracy of its science entries is comparable to, but not quite as high as that of Britannica. However, just about every topic and statement in this book can be followed up by referring to Wikipedia, whose articles are freely accessible, provide an up to date overview and introduction, and are a source of further academic references.

For a comparison of Wikipedia and Britannica, see Nature Special Report, vol.438, p.900, 2005 (available at http://inspercom.org/wp-content/uploads/2015/06/GILES_Internet-encyclopaedias-go-head-to-head2005Cit.496_Junho-de-2015.pdf , and also http://en.wikipedia.org/wiki/Reliability_of_Wikipedia [both accessed 14 July 2019].

References

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