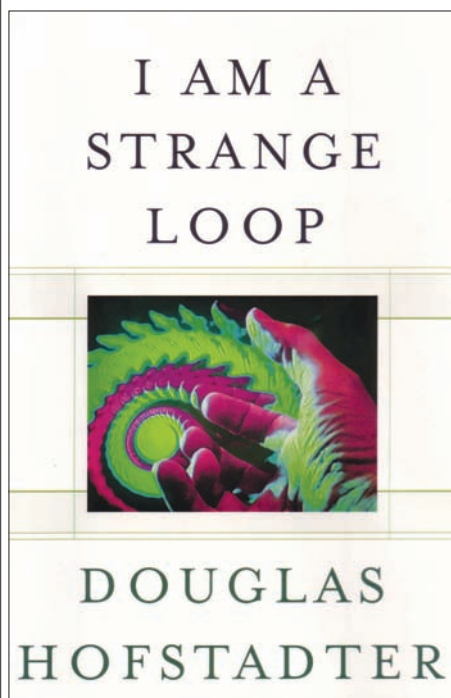


BOOKSHELF



I Am a Strange Loop by Douglas Hofstadter, Basic Books. Hardback ISBN 9780465030781, £15.99 (\$26.95).

Douglas Hofstadter is a truly exceptional person. His remarkable academic life followed a path that reflected his evolving interests in mathematics (graduation in 1965), physics (PhD in 1975), and cognitive sciences (his main field of research ever since). He is also captivated by literature, music, philosophy and other forms of high-level human creativity – probably because they are particularly beautiful expressions of consciousness, a more elusive activity that somehow emerges from within our “thinking machine”, the brain.

Hofstadter is best known for having written *Gödel, Escher, Bach: an Eternal Golden Braid* (*GEB*), undoubtedly an inspired masterwork that was immediately recognized as a breakthrough in scientific literature. Despite being a brilliant and original work, most readers of *GEB* might feel uneasy when asked to summarize in a few sentences the main message of this unusual “metaphorical fugue on minds and machines in the spirit of Lewis Carroll”, which lasts for 777 (plus 22) pages. This is not a criticism. Many works of art can be appreciated, enjoyed and admired, even if we fail to grasp the main idea inspiring the artist. Maybe revolutionary breakthroughs – in art and certain areas of science – are naturally difficult to master at first and

remain somewhat foggy in the minds of the “amateur”. In any case, *GEB* is certainly at the top of the list of books that I would take with me to a desert island. It has enough content and structure – not to mention depth and broadness – to provide thought-provoking reading for a very long time, and being alone on a desert island is an ideal setting for asking what we mean when we say “I”. Frankly, I’ve never read *GEB* in its full extent, from cover to cover. I prefer to see it as a collection of great wonders that visitors can enjoy in several possible sequences, even skipping a few of them. It’s impossible to visit all “great wonders of the world” in a single lifetime.

This browsing attitude (jumping back and forth between chapters and sections) or even opening the book at a random page and enjoying a few pages, is probably a good indication that I am one of the many readers who Hofstadter had in mind when he grumbled that *GEB* has been misperceived as “a hodgepodge of neat things with no central theme”. Apparently, this was one of the factors that triggered him to embark on the braiding of *I Am a Strange Loop* – 432 pages devoted to the “I” theme, 28 years after the eternal golden braid of *GEB*. I presume he would have finished much earlier had he not become a victim of his own (recursive) Hofstadter’s Law: It always takes longer than you expect, even when you take into account Hofstadter’s Law. I would also have written this review long ago, if I were not an enthusiast of this law...

In this more recent work, Hofstadter revisits several of *GEB*’s topics, such as Gödel’s inspiring work on self-referential systems and “self-engulfing TV screens”, now magnificently represented in colour and with higher resolution than before, which provide a striking illustration of a self-referential loop (despite the absence of the “black hole” seen in the original screenings). However, the new book focuses on the scientific, philosophic and spiritual issues related to the ever-elusive nature of mind and consciousness. The author recognizes this as a daunting task: “our very nature is such as to prevent us from fully understanding its very nature.”

GEB’s emblematic actors (Achilles, Tortoise and other mythical characters who had metaphorical dialogues interspersing the main chapters) are absent in *I Am a Strange Loop*, giving it a seemingly more relaxed fluidity and somewhat reducing the “hodgepodge”

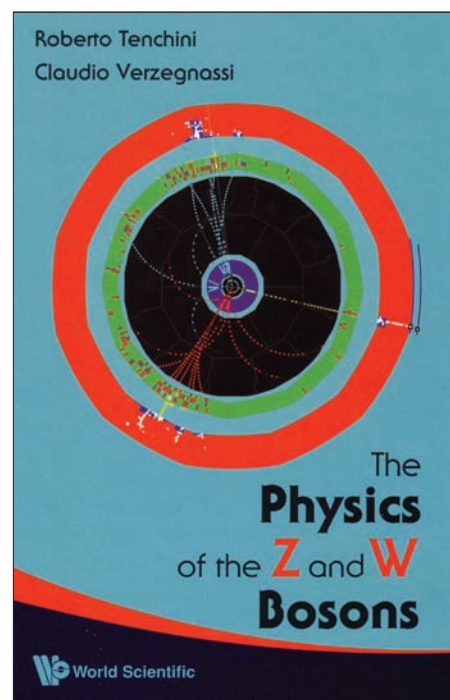
feeling. The feeling is not entirely gone, however, and we can use another of Hofstadter’s pictorial expressions to qualify it as “a random-looking swirl of pockmarked, bluish-white globs that reminded me a bit of some kind of exotic cheese...”

Like the topic it addresses, *I Am a Strange Loop* has elusive parts and hard-to-follow concepts, but it retains a surely poetic (even beautiful) literary exquisiteness, providing delightful reading that I do not remember experiencing with any other scientific book. I wholeheartedly recommend it to anyone interested in “the mind’s I” and to those looking for a scientific book written at the highest literary level. A warning, though: you may want to have a good English dictionary within arm’s reach. I should also recommend reading *The Mind’s I* by Hofstadter and Daniel Dennett, another delightful selection of “fantasies and reflections on self and soul”, which will trigger your mind into wondering “what is the mind, who am I, can machines think?”, through extraordinary stories and disturbing commentaries.

Carlos Lourenço, CERN.

The Physics of the Z and W Bosons by Roberto Tenchini and Claudio Verzegnassi, World Scientific. Hardback ISBN 9789812707024, £48 (\$89).

This book presents a nice review of



LEP physics written by two distinguished physicists, a theorist and an experimentalist, who both had a prominent role in that important scientific endeavour. In fact, since LEP – together with the SLAC Linear Collider and the Tevatron – was essential for the precise experimental verification of electroweak theory, to describe those epoch-making accomplishments adequately, one has to go deep inside the workings of the physics of the Standard Model. This book, therefore, is nothing more than a particularly effective and original presentation of electroweak interactions, theory and experiment, but from a different angle compared with ordinary textbooks.

The formalism of the theory is introduced in detail from the beginning of the book, followed by a derivation of the crucial predictions to be tested. The authors then describe the relevant features of the LEP machine and detectors, together with the experimental strategies. Finally, a summary of the results and their significance is discussed.

Along the way the reader is led directly to appreciate the close interplay between the predictions obtained by the work of a generation of theorists and the highly sophisticated experimentation designed and performed by the LEP collaborations, which was needed for the ultimate test of the predictions. In this respect the book provides a brilliant account of the actual way

of doing particle physics nowadays, told by the scientists involved. It follows that this volume is also a good introduction to the next phase of particle physics, which will soon start at CERN with the LHC.

Guido Altarelli, CERN.

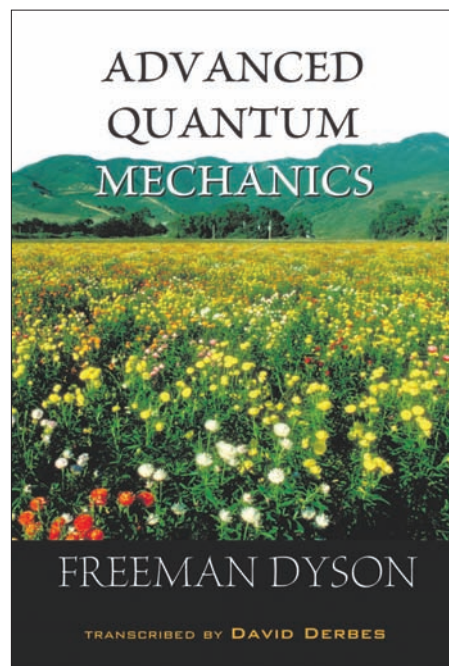
Universe or multiverse? Edited by Bernard Carr, Cambridge University Press. Hardback ISBN 0521848415, £45.

While “universal” usually refers to the whole creation, the word multiverse indicates the ensemble of other possible universes in which the constants of physics are different from our universe. In this book, eminent particle physicists and cosmologists (Steven Weinberg, Stephen Hawking, Frank Wilczek and Andrei Linde among others), as well as philosophers, discuss different views on the multiverse. It consists mainly of a collection of contributions to a 2003 conference, which have been adapted to a semi-popular level by the authors and to bring in the most recent developments in theoretical cosmology.

The anthropic principle is the underlying theme throughout the book. Some of the authors support the anthropic principle in a multiverse context; some are less comfortable with it. The main question – why is the universe the way it is? – is intimately related to the anthropic principle. Are we living in a tiny fraction of the universe? Or in a particularly selected member of an ensemble of possible universes? How does the presence of observers select a particular branch of the wave function of the universe? The arguments are addressed from points of view of cosmology, particle physics and philosophy.

Another key issue is that the multiverse cannot be observed, so is not experimentally verifiable and therefore may not be “scientific” in a strict sense. However, we do observe cosmic accelerated expansion. In an inflationary scenario, and following a Copernican approach, this implies that there are regions of this universe – even if it is only one – that we will never be able to explore, since they are beyond the limit our horizon will ever reach. Are they, then, not physical? On the other hand, the multiverse may be the outcome of a more general theory, such as string theory or M-theory, which can be tested in other aspects – and therefore falsifiable – in the Popperian sense.

These are just some of the topics the



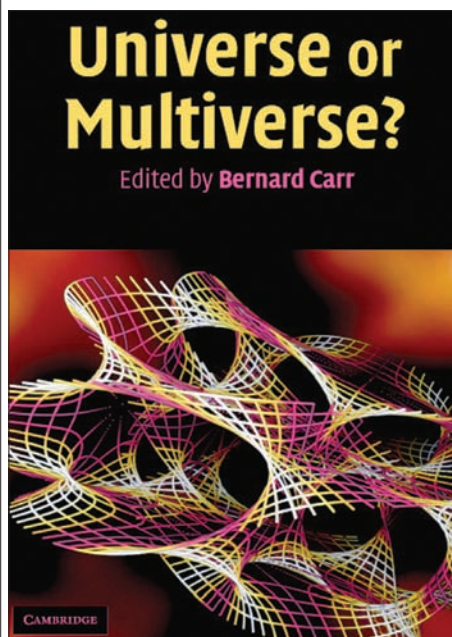
authors discuss in detail. The book is divided into four parts. After an overview section, the astrophysical and cosmological points of view are presented, followed by particle-physics aspects and philosophical topics (a theistic perspective is also introduced), although this separation is not clear-cut.

Reading this book is a complex and rich experience. As an experimental cosmologist, I found it stimulating to reflect on the theoretical counterpart of my everyday experience. The level of the book requires a significant background in physics, although an effort is made to explain the details. While it is definitely not a textbook, I find it useful as recommended reading as an introduction for undergraduate students.

Luca Valenziano, INAF/Istituto di Astrofisica Spaziale e Fisica Cosmica, Bologna, Italy.

Advanced Quantum Mechanics by Freeman Dyson, transcribed by David Derbes, World Scientific. Hardback ISBN 9789812706225 £31 (\$58). Paperback ISBN 9789812706614, £15 (\$28).

Freeman Dyson is perhaps best known for his work in the early days of QED, showing the equivalence of the approaches of Richard Feynman, Julian Schwinger and Sin-Itiro Tomonaga. The book *Advanced Quantum Mechanics* is an account of early lectures that Dyson gave at Cornell in 1951, which have been transcribed by David Derbes.



This book is likely to be of interest mainly to historians of science. I have long believed (and still believe) that there is much to be gained from going back and reading the original works by founders of a field. For example, I think that Feynman's books *Quantum Electrodynamics* and *Theory of Fundamental Processes* are still interesting and useful to both beginning students and researchers, even though much of the material is dated. That said, after trying hard to find gems in this book, I must say that it's not in anywhere near the same class. This might sound harsh, but it was perhaps to be expected of a book that tries to sketch out the basic ideas of a brand new field just as it was beginning to be understood.

The one thing I did think was done rather well was the relativistic treatment of the spectrum of the hydrogen atom, which is found algebraically and, to my mind, rather elegantly and efficiently. The treatment of fluctuations in fields had some nice points – in particular the suggestion to look at a

paper (LP Smith 1946 *Phys. Rev.* **69** 195) that treats QED in a cavity and the approach to the classical limit.

Some of the heuristic and semi-classical arguments in dealing with radiative corrections may be of interest for a classroom discussion. In particular, an approximate treatment of electron–positron pair creation from the decay of an excited nuclear state would be an interesting subject to discuss – both as it appears in this book, as well as how it might be treated using more modern methods. That said, the subject of QED has advanced so far from when the material was originally presented that I would argue that this is rather weak motivation for buying the book. In any event, the same material is also available online, at <http://arxiv.org/abs/quant-ph/0608140>.

John Swain, Northeastern University.

Books received

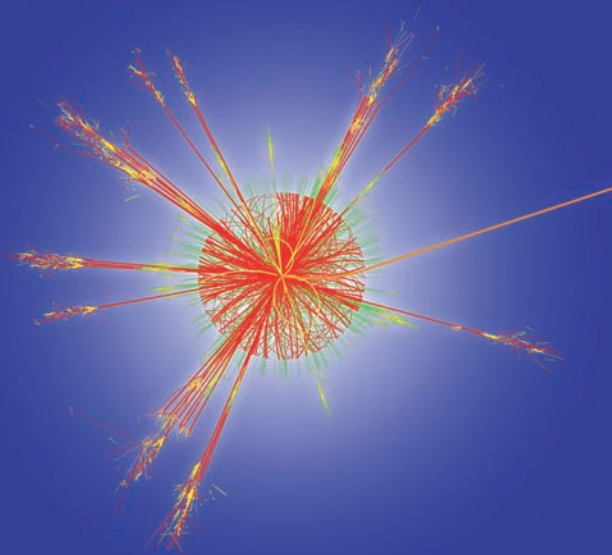
Essential Quantum Mechanics by Gary E Bowman, Oxford University Press.

Hardback ISBN 9780199228928, £45 (\$90). Paperback ISBN 9780199228935, £22.50 (\$55).

Quantum mechanics – central not only to physics, but also to chemistry, materials science, and other fields – is notoriously abstract and difficult. *Essential Quantum Mechanics* is a uniquely concise and explanatory book that fills the gap between introductory and advanced courses, or between popularizations and technical treatises.

By focusing on the fundamental structure, concepts, and methods of quantum mechanics, this work emphasizes both physical and mathematical understanding. A modern perspective is adopted throughout – the goal, in part, being to gain entry into the world of “real” quantum mechanics, as used by practicing scientists. This book should be useful for undergraduate and graduate students in quantum mechanics, mathematics, materials science, and chemistry.

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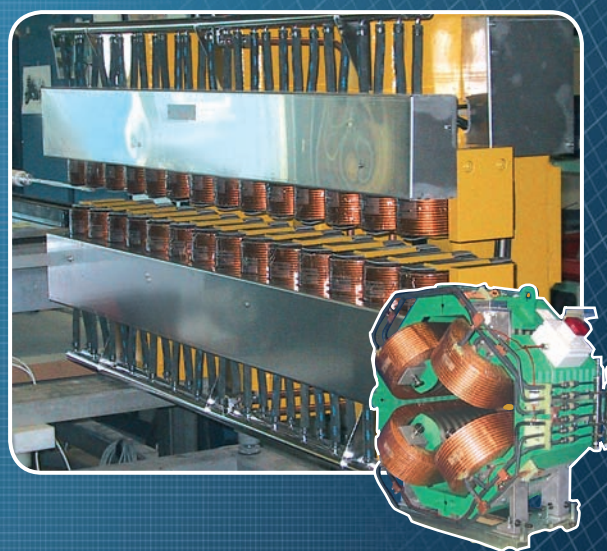


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