

Bookshelf

Festive Bookshelf

It will soon be time for many of us to spend some time with friends and family, after an exciting year that saw the discovery at CERN of a new particle consistent with being the long-sought Higgs boson. This end-of-year selection includes two books published hot on the heels of that announcement, together with others for more relaxed reading.

Higgs: The Invention and Discovery of the 'God Particle'

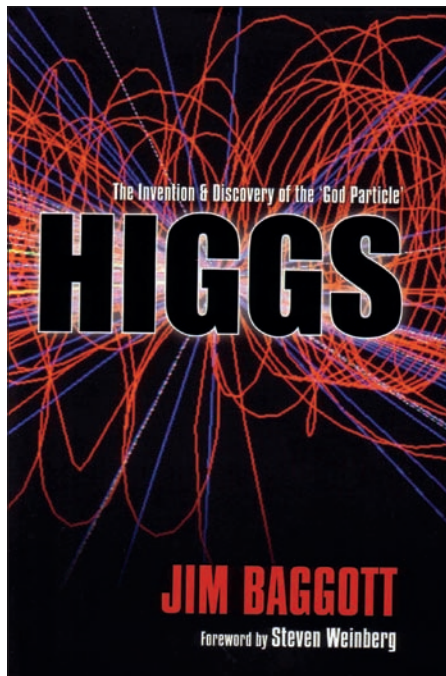
By Jim Baggott

Oxford University Press

Hardback: £14.99 \$24.95

Jim Baggott is the author of *The Quantum Story*, an exceptionally interesting and detailed "biography" of quantum physics, very nicely exposed over almost 500 pages. Having had the pleasure of reviewing this wonderful book for the *CERN Courier* (July/August 2011 p55), I was quite happy to learn, through a text by Steven Weinberg that appeared on 9 July this year on *The New York Review of Books* (NYRB) website (www.nybooks.com/blogs/nyrblog/2012/jul/09/big-higgs-question/), that Baggott had written a new book, succinctly titled *Higgs*. However, I was perplexed to realize that the new book had been finished just two days after the seminar at CERN on 4 July, when the ATLAS and CMS collaborations announced "the discovery of a new particle that seems to be the long-sought Higgs particle" (to quote Weinberg). Indeed, most of the book had been written well before, in anticipation of the day when the discovery would be announced.

Unfortunately, I became rather disappointed soon after getting my hands on the new book. Apart from Weinberg's "foreword" (most of it available through the NYRB blog) and from the final chapters, most of the book left me with a feeling of "déjà vu", constantly reminding me of pages from *The Quantum Story*. As the author writes in the preface, "the present book is based, in part, on that earlier work". Some sentences were refurbished and some (not all) minor mistakes were corrected, but if you have read the original you will feel that much of the new book is a "remake". At least Baggott has added a few Feynman diagrams, which were clearly lacking in *The Quantum Story*, such as the one relating the GIM mechanism to the dimuon decay of the neutral kaons, but a lot more illustrations (and a few equations) could have been included to facilitate the understanding of



certain narratives.

The final three chapters of *Higgs*, written specifically for the new book, should have gone through an extra round of editing to eliminate several imperfections. For instance, the general reader will be puzzled when reading that the CMS collaboration is led by Guido Tonelli (page 188), that the CMS spokesperson is Tejinder Virdee (page 189) and that Joe Incandela is "acting as spokesperson for CMS" (page 215); the three sentences were no doubt correct when they were written but producing a good book implies more than copy/pasting sentences written over a period of several years. In general, the original chapters provide enjoyable reading but some details reveal that the author followed the action from far away and, in a few instances, became sidetracked by blog-driven animation. This constitutes an eye-opening experience for some readers (such as myself). Having followed the reality of the discovery as an insider and now seeing how things are written up in a popular-science book will allow me to assess the kind of "acceptance correction" that I should apply to analogous descriptions of the many things of which I have no direct knowledge. As an aside, I was amused to see that Baggott decided to illustrate the LHC's achievements using a dimuon mass distribution that I helped to prepare but astonished to see that an error was introduced in the CMS Higgs plot when restyled for inclusion in the book. Things

were really done too much in a hurry.

If you are looking for a good book to read over the end-of-year break, I highly recommend *The Quantum Story*, a dense plot with heroic characters, covering the fantastic odyssey of quantum physics. But how many of us have crossed paths with Einstein, Bohr, Pauli or Dirac? It is refreshing to read books about present-day physics and physicists, where one can enjoy the plot and recognize the main characters. In that respect, *Higgs* is an interesting alternative and has the advantage of being much faster to read. Another option for people specifically interested in reading about the "hunt for the God particle", is *Massive*, by Ian Sample, an easy-to-read, lively book that gives a fast-paced and well humoured overview of the history behind and surrounding the Higgs boson, until mid-2010 (*CERN Courier* December 2010 p51), although the reader needs to be patient and ignore the annoying detail of seeing CERN written as Cern and RHIC as Rick ... oh, well.

I am looking forward to reading more books about the LHC experiments and their discoveries, concerning Higgs physics and other topics, written by people who made those experiments and those discoveries. These are important issues and they deserve being treated by professionals with direct knowledge of the inside action, who can provide much more information – and much more accurately – than (award-winning) popular-science authors.

● Carlos Lourenço, CERN.

Higgs Discovery: The Power of Empty Space!

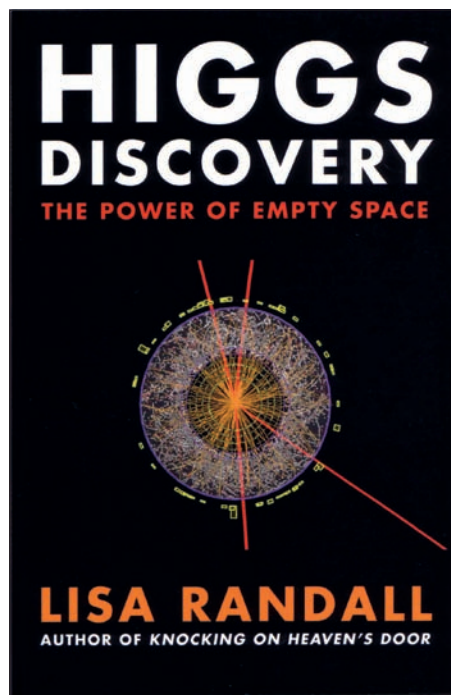
By Lisa Randall

Bodley Head

Paperback: £4.99

Readers of *CERN Courier* need no introduction to Lisa Randall, the well known theoretical physicist. Her previous books, *Warped Passages* and *Knocking on Heaven's Door*, are exceptionally interesting and surprisingly easy to read, especially when considering the complexity of the topics that she addresses. I cannot judge if the fluidity of her writing is a natural talent or the result of much hard work through several editorial iterations – but the result is outstanding. Her new book, *Higgs Discovery: The Power of Empty Space*, reports her reactions to the announcement by the CMS and ATLAS experiments that "a particle related to the Higgs mechanism had been found" – "I was flabbergasted" – and compiles her answers to the many

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questions that she has been asked since.

This is a small book of fewer than 50 pages, which can be read in a couple of hours. The writing style is refreshing and informal, with a warped sense of humour that helps to grab the target audience: the people who were fascinated with the discovery without knowing why. Sometimes it is a little repetitive and almost feels like “Higgs for dummies” but this is more a compliment than a criticism. Nowadays, most people forget to explain “the basics”, a challenge that Randall excels at. And she does not forget to wrap her teachings with passages that extend well beyond high-energy physics: “The Higgs boson discovery is more likely to be the beginning of the story than an end.” I wonder if she purposely paraphrased Winston Churchill.

I certainly agree that “the discovery is truly inspirational” and I am also glad that we can avoid the need to explain why not finding the Higgs boson would be even more interesting than actually finding it.

● Carlos Lourenço, CERN.

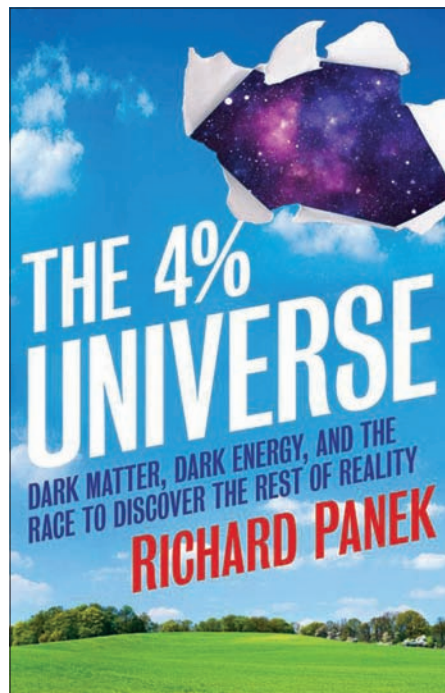
The 4% Universe. Dark Matter, Dark Energy, and the Race to Discover the Rest of Reality.

By Richard Panek

Oneworld

Paperback: £9.99

The 4% Universe is, as you might gather from the title, an account of how the scientific community has come to the idea that only (a little over) 4% of the universe seems to be made of the same stuff as you



and me. In other words, normal matter is only a tiny percentage of all that there is, with the remainder being about 23% dark matter holding galaxies together and 73% being dark energy, which drives the acceleration of cosmic expansion.

This account is unusual, written more like a thriller than in the style of many popularizations. There is a great emphasis on not only describing the sequences of events leading to the discoveries of dark matter and dark energy but also of the people involved. Personalities, co-operations, disagreements, collaboration and individualism all take a large part of the stage, making the book lively and readable. I had originally planned to read it in chunks over a few days but found myself taking it all in during a single sitting, somewhat later into the night than I had planned!

This book would be a nice gift for anyone with a genuine interest in science but, oddly enough, it may be a hard read for someone without at least some background knowledge. At the same time, it is short on details (no equations, graphs, plots or photographs) for a practising physicist who is not so interested in the personal dramas involved. If you're looking for a book about dark matter and dark energy *per se*, then this may not be the best choice. While the science is probably more than 4% of the book, the bulk is about sociology, history and politics.

Nevertheless, technical terms are well explained, down to footnotes for those who need to know what the Kelvin scale or a megaparsec is. The physics is pretty

good, too, but not perfect in all places. For example, the discussion on the Casimir effect seems not quite to get that the energy density between the plates is negative with respect to the region outside.

The emphasis is very much on astronomy and astronomical observation and how data are collected and presented. Particle physicists should not expect much about the direct search for particles that could make up dark matter. The LHC merits a brief mention but without further discussion. Axions and neutralinos are introduced as dark-matter candidates but without any explanation of the ideas that gave rise to them.

Apart from the insights into the sociology of how “big astronomy” is done, I think that the book's greatest merit is to drive home how much our view of the universe has changed in the past 100 or so years – from a rather simple, static universe to an expanding, even accelerating one, with far more stars and galaxies than had ever been imagined and, now, the realization that all of that visible matter may be only a few per cent of all that is. That, as well as to show how cosmology has made the giant step from being little different from theology to being a real scientific discipline.

● John Swain, Northeastern University.

About Time: From Sun Dials to Quantum Clocks, How the Cosmos Shapes Our Lives – And How We Shape the Cosmos

By Adam Frank

Oneworld

Paperback: £12.99

In 1963, Bob Dylan penned the song *The Times They Are a-Changin'*, which quickly became the anthem for a new generation. But according to Adam Frank's provocative book, the times have always been changing: first, hunter-gatherers driven by the immediacy of hunger; then pioneer farmers dictated by the seasons. After that came a series of industrial revolutions: workers having to move to towns and adapt to factory drudgery; mechanical transport extending the span of distance of daily life; and today's digital devices compressing time and distance even further (with the constant pressure to download the latest app or have the newest browser update).

About Time compares the accelerating pace of this race towards no clear destination with the evolution of cosmology, from ancient mythology to the modern picture of multiple universes. The changing world picture is continually benchmarked against the seemingly unpredictable emergence of new lifestyles as technology advances.

In doing so, the story line can lurch startlingly at times. It leaps from the

introduction of labour-saving electrical household appliances in the early 20th century to the commissioning of the Mt. Wilson Hooker telescope; from the measurement of galactic red shifts and an apparently expanding universe to the cultural revolution brought about by domestic radio. The ideas of quantum mechanics are then wedged into two pages.

Frank's illustrations cover a wide range. I appreciated being reminded of the tragic figure of British music producer Joe Meek, whose 1962 instrumental piece marking the technological miracle of *Telstar* resonated in contemporary lifestyle as the first British recording to appear in the US charts – one year before the Beatles, who the mercurial Meek had meanwhile chosen to ignore.

The book traces the key historical giants, from the Ancient Greek philosophers and before through to Albert Einstein, Edwin Hubble and beyond. Some figures are less familiar, for example Ambrose Crowley, a British industrial magnate who was a contemporary of Isaac Newton. Despite his obscurity, Crowley's impact on technology is compared with that of Newton's on science.

Some conventional ideas are sold short, for example the role of time in quantum physics and its deep connection with antimatter. Paul Dirac, the pioneer of antimatter, appears in a cameo role to introduce a whole section on the iconoclast Julian Barbour and his provocative book *The End of Time*. Barbour suggests that the continual quest to understand time fails because time itself is an illusion.

Although Frank's *About Time* does not venture that far, it is an unconventional book, which could motivate an inquisitive young mind.

● *Gordon Fraser is author of Quantum Exodus: Fugitive Jews, the Atomic Bomb, and the Holocaust (OUP 2012).*

Reinventing Discovery: The New Era of Networked Science

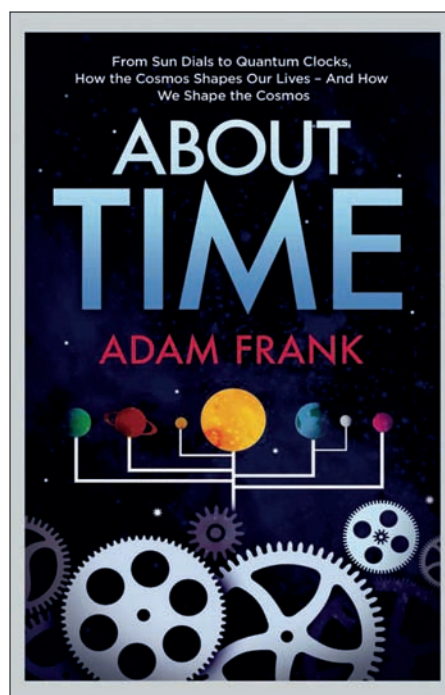
By Michael Nielsen

Princeton University Press

Hardback: £16.95 \$24.95

The term “disruptive innovation” is used in the business world to refer to how new technologies sometimes upend whole industries, just as the telephone did to the telegraph and the mobile phone is doing to the telephone. The internet has disrupted a whole slew of industries: think of the impact of online bookstores on their bricks-and-mortar analogues, or how professional journalism has been challenged by free and often high-quality amateur blogs and other forms of online social media.

The profound question raised in this

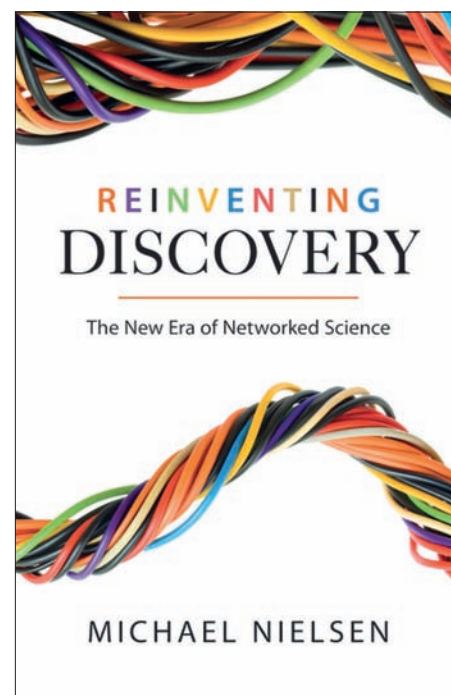


book, written by Michael Nielsen, a young pioneer in the field of quantum computing, is whether the scientific establishment may be facing a similar disruption. As the web enables new ways of sharing ideas online and participating in science over the internet, could it favour amateur involvement and threaten the status quo of professional science?

The author illustrates many ways in which web-based technologies are challenging traditional models of sharing and collaboration in science. These range from popular open-access forms of scientific publishing such as arXiv's online preprints to a blog where Cambridge mathematician Tim Gowers successfully enlisted help from colleagues and strangers to crack a tough mathematical nut, to the computer game *FoldIt*, where thousands of players help to solve protein-folding problems that stymied professionals.

The backbone of this book is a thoughtful review of what “open science” means. This emerging buzzword is inspired by the open-source movement in software but, as Nielsen correctly points out, science has been aspiring to greater openness for centuries. Indeed, scientific articles evolved to accelerate the dissemination of scientific knowledge and patents were meant to do the same for new technologies. Yet these tools have been gradually co-opted for other uses – measuring researcher productivity and valuing companies – that often seem at odds with their original goal of promoting greater openness.

The strength of Nielsen's thesis is that



he does not propose glib solutions, nor is he naive about the entrenched social order that fuels much of the “publish or perish” mentality of the academic world. He is wisely wary of trivializing the “crowd sourcing” of scientific problem solving, something that is hard to do well. Rather, he details a number of best practices for moving the open-science agenda forward, using online technologies. This thoughtful approach should be immediately useful to professional and amateur scientists, alike.

If, indeed, the internet is ushering in a new era of networked science, as this book's subtitle suggests, it will surely have some downsides, such as decreased job security for white-collar academics in industrialized countries. But the potential upsides of such disruptive innovation, as this book so eloquently reveals, could be huge.

● *François Grey, Citizen Cyberscience Centre, CERN.*

Books received

From Eternity to Here: The Quest For the Ultimate Theory of Time

By Sean Carroll

Oneworld

Paperback: £10.99 \$12.24



Twenty years after Stephen Hawking's *A Brief History of Time*, Sean Carroll takes investigations into the fundamental nature of time to the next plane – to what happened before the Big Bang. Here Carroll, a leading theoretical cosmologist,

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delivers a paradigm-shifting approach to understanding the mysterious “arrow of time” in which other universes experience time running in the opposite direction to our own. Exploring subjects from entropy and quantum mechanics to time travel and the meaning of life, Carroll presents a dazzling view of how things came to be.

More and Different: Notes From a Thoughtful Curmudgeon

By Philip W Anderson

World Scientific

Hardback: £51

Paperback: £25

E-book: £67



Now nearly 90, Philip Anderson spent many years at two important universities – Princeton in the US and Cambridge in the UK – as well as Bell Laboratories, from 1949–1984, and shared

the 1977 Nobel Prize in Physics, for “fundamental theoretical investigations of the electronic structure of magnetic and disordered systems”. In 1972, he wrote a well known article, “More is Different”, in

which he eloquently countered the purely reductionist view of science, with a broader perspective based on emerging complexity and “broken symmetry” in macroscopic systems. This sparked a writing career in parallel to his scientific work, with many articles in *Physics Today*, for example. Forty years later, the title of this collection of essays echoes that of the earlier article and it serves well to summarize succinctly the many and varied topics that Anderson has thought and written about.

Albert Einstein Memorial Lectures

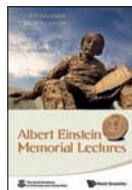
By Jacob D Bekenstein and Raphael Mechoulam (eds.)

World Scientific

Hardback: £51

Paperback: £22

E-book: £67



This volume consists of a selection of the Albert Einstein Memorial Lectures presented annually at the Israel Academy of Sciences and Humanities, since it was inaugurated by the academy following an

international symposium held in Jerusalem in March 1979 to commemorate the centenary

of Albert Einstein's birth. Delivered by eminent scientists and scholars, including several Nobel laureates, they cover a broad spectrum of subjects in physics, chemistry, life science, mathematics, historiography and social issues. In particular, Carlo Rubbia, who delivered the lecture in 1998, describes “Harmless Energy from Nuclei”, Steven Weinberg writes on “Beautiful Theories” (1984) and Haim Harari elucidates “The Structure of Quarks and Leptons” (1983).

On Being: A Scientist's Exploration of the Great Questions of Existence

By Peter Atkins

Oxford University Press

Hardback: £10.99 \$19.95

Paperback: £8.99 \$13.95



In this slim volume, Peter Atkins considers the universal questions of origins, endings, birth and death to which religions have claimed answers. With his usual economy, wit and elegance,

unswerving before awkward realities, Atkins presents what science has to say and science's capacity to reveal the deepest truths.

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