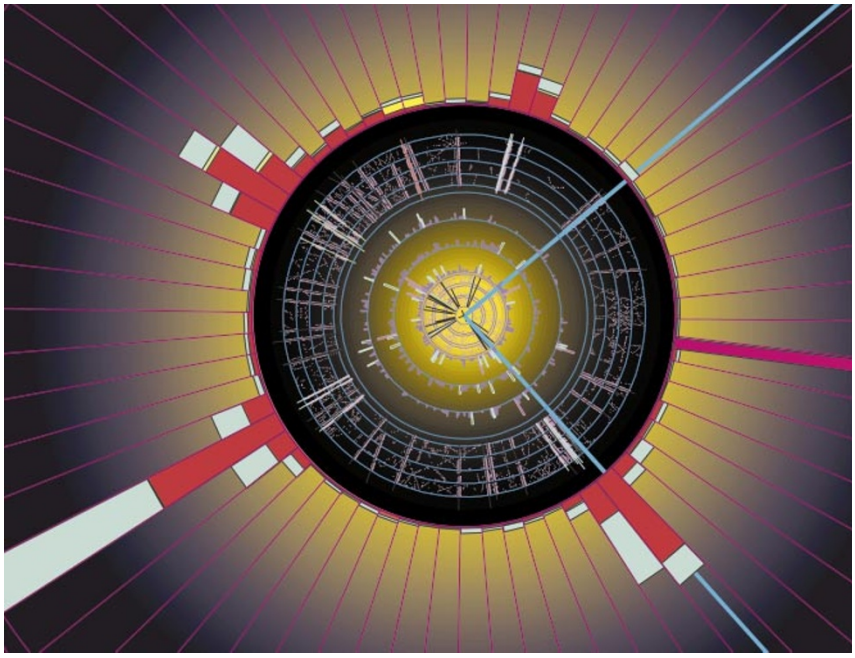
Taking the subatomic Grand Tour

The secrets of the world of elementary particles revealed.

The Particle Odyssey: A Journey to the Heart of Matter
by Frank Close, Michael Marten & Christine Sutton
Oxford University Press: 2002. 246 pp. £29.95, $45.

Ken Peach



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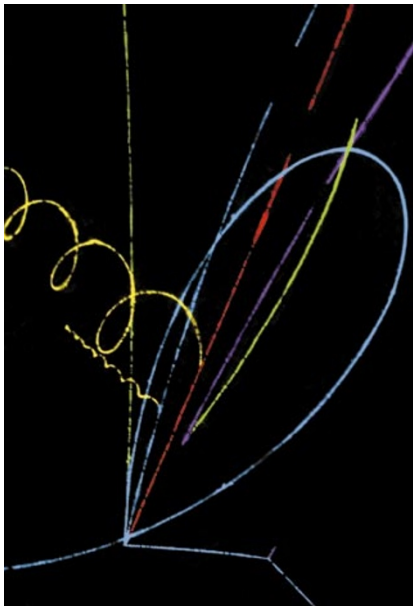
Problem particle: the top quark, here decaying into muons (blue tracks), wasn't discovered until 1995.

The development of the standard model of particles and their interactions is one of the major scientific achievements of the twentieth century. The electron was the first 'elementary particle' to be discovered, by J. J. Thomson (working largely on his own) in 1897, and the top quark was the last of the standard model's 'fundamental fermions' to be discovered, by two large teams at the Tevatron near Chicago in 1995. In between, special and general relativity, quantum mechanics and a deep understanding of symmetry (explicit and hidden, global and local, absolute and spontaneously broken) have transformed our understanding of the dynamics of the Universe. Within this framework, a remarkably complete description of the way in which the Universe works has been developed, and all but one of its ingredients experimentally verified — only the elusive Higgs particle remains undetected.

The Particle Odyssey describes a century of discovery and creativity through a series of stunning images and photographs. The text explains clearly and non-mathematically the significance of these discoveries in the development of the standard model. Each ingredient (quarks, leptons, gauge bosons and other whimsies associated with high-energy physics) is described and illustrated, along with photographs and biographical details of key figures in the story.



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Gone in a flash: the charmed sigma particle is inferred from tracks left by other particles.

The book's 12 chapters cover broad themes, loosely following the historical development of the subject. Two chapters cover the technology — accelerators and detectors — and a third looks at the applications of these in other branches of science and society. The style is conversational, with the imagery sometimes as vivid as the photographs. Although there are some crucial or illustrative histograms and scatter plots (the 'picture' that the physicist really wants to see), the emphasis is on people, events and equipment. The book is written partly as history and partly as detective story, identifying 'who' as well as 'what', 'where', 'when' and 'why'. It will be a useful source for future historians of the science of the twentieth century, limited only by the lack of references to the original papers.

The present book builds upon *The Particle Explosion*, published 15 years ago by the same authors. Although its chapters share headings with the earlier book, it is more than 'Particle Explosion II — the Sequel'. It is easy to forget just how much progress there has been in high-energy physics over the past 15 years. The main ingredients of the standard model had been discovered by then, but there was still scope for alternative explanations. Most of the loopholes have since been closed: the top quark has now been discovered, the electroweak sector has survived precision scrutiny at the Large Electron–Positron Collider at CERN, quantum chromodynamics has been explored in detail by the HERA experiments at DESY, both solar and atmospheric neutrinos have been shown to oscillate, the tau neutrino has been observed, hints of the quark–gluon plasma have been seen, and matter–antimatter asymmetries have been measured in B-mesons at the KEK-B and PEP-II B-factories. The interplay between high-energy physics and cosmology has been enhanced. All this is reflected in the new book, with about one-third of the text and more than 250 new images illustrating this progress. If *Explosion* conveyed the image of creative, if chaotic, energy, *Odyssey* gives the impression of a journey surveyed from a vantage point, from which one can see the route traversed so far and contemplate the road that lies ahead.

In short, *The Particle Odyssey* is a beautifully illustrated and eminently readable introduction to high-energy physics. It provides an excellent answer, for both the high-energy physicist and the general reader, to the party question that high-energy physicists sometimes find difficult to answer — what is it exactly that you do? ■

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