decades. His solution, now known as the Kerr metric, is the basis for all modern general relativistic calculations of spacetime around spinning black holes. Despite the magnitude of that achievement, Kerr's story has been largely untold. All too often, nonspecialist books on relativity refer to Kerr cryptically as the "New Zealand mathematician" and wrap up his contribution in a paragraph or less. In this book, Melia rightly brings Kerr back into the spotlight to ensure that his contribution to relativistic physics is celebrated.

The book reads well. It is the sixth book overall and third for a general audience written by Melia, a high-energy astrophysicist who specializes in astrophysical black holes. Melia adds a human element to a technical subject by including archival photographs of the participants from Kerr's era. He also spent months interviewing Kerr, now 75 years old and living in New Zealand. As a result, the reader gets a sense of immediacy in the descriptions of Kerr's struggle with the equations and the exhilaration of his success.

But the focus on Kerr and his achievement is also a weakness of the book. Because Kerr's breakthrough was highly mathematical, Melia could describe the technical details in only the most general terms; his complete biography of Kerr, including the derivation of the Kerr metric, takes up less than half of his very thin book. To make the story more self-contained, Melia adds at the beginning of the book a few short chapters describing the history of relativity and, at the end, a brief summary of recent astrophysical black hole observations. Although the introductory chapters assume no previous knowledge of relativity, they also contain no diagrams to aid in the understanding of the theory's difficult concepts. The author is in such a hurry to get to Kerr's story that most general readers will be left floundering over such topics as time dilation and the equivalence principle. Therefore, it is difficult for me to recommend Melia's popularization to those who have not yet encountered relativity in other books. It would be more appropriate for readers who have already encountered a more complete book on black holes and relativity, such as Kip Thorne's *Black Holes and Time Warps: Einstein's Outrageous Legacy* (W. W. Norton, 1995), but want more details on one of the unsung heroes of the field.

Perhaps the best audience for *Cracking the Einstein Code* would be current graduate students and postdocs. They would meet a man who, through the combination of luck, skill, and hard work, had that one insight to make an everlasting contribution to physics. Roy Kerr's story should be an inspiration to young scientists to keep their eyes and mind open for interesting problems and to follow their instincts. After all, who knows when the next "young mathematician from New Zealand" may shape the future of physics?

David Ballantyne
Georgia Institute of Technology
Atlanta

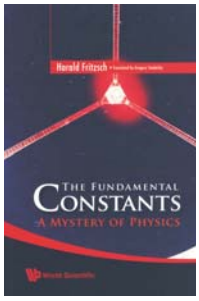
The Fundamental Constants

A Mystery of Physics

Harald Fritzsch (translated from German by Gregory Stodolsky)
World Scientific, Hackensack, NJ, 2009. $36.00 (195 pp.). ISBN 978-981-281-819-5

Like Plato's *Timaeus* or Galileo's *Discorsi*, particle physicist Harald Fritzsch's *The Fundamental Constants: A Mystery of Physics* is an imagined dialog

in which questions are posed and answered. In Fritzsch's book, two of the three characters are based on real people—Isaac Newton and Albert Einstein—and the third is the purely fictitious modern-day particle physicist Adrian Haller. The three scientists mainly hold their discussions at the Athenaeum faculty club on Caltech's campus, but also have occasion to converse during excursions to SLAC and other sites in California. The changing settings serve to illustrate the life of modern physicists and some of the more charming environments associated with their work.



The Fundamental Constants is a translation of Fritzsch's *Das Absolut Unveränderliche* (Piper, 2005). As one of the founders of quantum chromodynamics and the standard model of particle physics, Fritzsch is a well-qualified author. Although the book's theme is centered about the constants of nature, the fictitious discourse also allows a present-day physicist to expound on the great advances of the past half century in response to questions posed by two icons of classical physics. The book delves deeply into the full history and elegance of modern physical theory, including quantum field theory, quantum electrodynamics, quantum chromodynamics, grand unified theories, supersymmetry, and string theory. It also demonstrates the role of the scientific method in those developments.

I liked the book's discussion of the fine-structure constant, from which it launches into the foundations of quantum electrodynamics. The historical anecdotes were interesting and accurate; some of them even describe Fritzsch's encounters with Richard Feynman and others involved in the development of modern quantum field theory. The sections about nuclear physics and the discovery of quarks and quantum chromodynamics were insightful, as expected given the author's credentials. Fritzsch covers the development of modern particle accelerators and explores the rationale for the Large Hadron Collider at CERN, which was under construction when the original German-language book came out. He includes a summary of the standard model and the Higgs mechanism; his discussions of the motivations for supersymmetry, string theory, and other grand unified theories are all quite good, as are his comments on the Big Bang and the time variation of the fundamental constants. I particularly liked the description, suitable for lay readers, of abelian versus nonabelian gauge theories. In fact, I plan to adapt some of Fritzsch's pedagogy for my own courses.

Much as I enjoyed the book, I found a few parts slightly irritating. Einstein and Newton are sometimes portrayed as bumbling fools waiting to be enlightened by particle physicist Haller. In parts, the fictional Einstein needs an explanation of early advances in quantum physics that the real Einstein would surely have understood. Moreover, Einstein is not given enough credit for having moved on to higher dimensional theories of gravity; modern string theories suggest that his intuition was actually remarkably good. Also, the criticism in chapter 12 of theoretical astrophysics and astronomy is completely inappropriate. Perhaps some of those stylistic aspects should be passed off as understandable bravado from one whose viewpoint is that of a modern particle physicist. In any event, they do not significantly detract from the book's overall entertaining and informative nature.

Although written by an expert, *The Fundamental Constants* is surprisingly accessible, and I would recommend it to anyone with an interest in the subtleties of modern physics. For the novice, the dialog device effectively communicates intuitive arguments in an entertaining way. Seasoned physicists, too, particularly those teaching introductory courses on modern physics, will find some of its explanations and insights quite useful.

Grant Mathews
University of Notre Dame
Notre Dame, Indiana

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