mathematics and in its revival, which was crucial for the emergence of 16th- and 17th-century mechanics. However, if all you knew of Greek mathematics was from Netz and Noel's book, you might incorrectly conclude that Archimedes discovered the method of exhaustion, conic sections, the notions of infinity and indivisibles, mathematical mechanics, and more. Netz also goes on to turn Archimedes into a scientific magician. In describing (very elegantly, I might add) how Archimedes finds the center of mass of a triangle in his *On the Equilibrium of Planes*, Netz says that Archimedes has told us "without even looking how the world must behave, where a triangle must balance," and Netz calls it an "act of magic" (page 147). Maybe, but Archimedes does begin the treatise with a series of seven crucial, empirically grounded assumptions about centers of mass and balances, and he consciously employs an idealization that the triangle, a plane figure, has uniformly distributed weight.

Netz hypes Archimedes' importance. Surely, many basic concepts in early modern science are absent from Archimedes—for example, experimentalism, algebra, probabilistic and genetic explanations, even mechanism. Archimedes was uninterested in biology, medicine, and the nature of matter. Netz's claim, based on six lines of the *Method*, that Archimedes "foresaw a glimpse of Set Theory" (page 202) baffles me inasmuch as Archimedes' argument about infinite sets generates paradoxes discovered in the 17th century and not resolved until the 19th century.

The *Method* and the *Stomachion* are important works, and Netz is doing some great things with them, and with the rest of the mathematical texts in the palimpsest. Yet barely a shred of evidence exists that the *Method* influenced anyone; only Hipparchus was perhaps influenced by the *Stomachion*, and even the evidence for that is circumstantial at best.

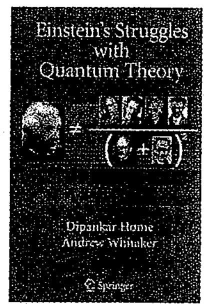
The Archimedes Codex is a fun read. When it succeeds, it does so very well. But I worry that readers will not know when it does not—when a conjecture is wild, an inconvenient manuscript omitted, the study of chronology twisted to serve an entertaining but false thesis, and so forth. The subject is so interesting and the authors so uniquely positioned to present it that I wish they had chosen a more restrained approach. The book is also a clever ploy to attract interest in finding the missing folios. And in that attempt, we can all wish the authors luck.

Einstein's Struggles with Quantum Theory

A Reappraisal

Dipankar Home and Andrew Whitaker
Springer, New York, 2007. $149.00 (372 pp.). ISBN 978-0-387-71519-3

In 1986 John Stachel, founding editor of the ongoing series *The Collected Papers of Albert Einstein* (Princeton University Press, 1987), wrote the article "Einstein and the Quantum: Fifty Years of Struggle," which also appeared later in his book *Einstein from "B" to "Z"* (Birkhäuser, 2002). He started with the following quote from a letter Einstein had written late in his life to his friend Michele Besso: "The whole fifty years of conscious brooding have not brought me nearer to the answer to the question 'What are light quanta?' Nowadays every scalawag believes that he knows what they are, but he deceives himself."



More than 20 years and 10 volumes of Einstein's collected papers later, I was expecting that a book with a title similar to Stachel's article would offer an update on our current understanding of the physicist's broodings on the quantum. Yet that is not what *Einstein's Struggles with Quantum Theory: A Reappraisal* is about. Apart from a passing reference to the first volume of the collected papers, authors Dipankar Home, a professor of physics at Bose Institute in Kolkata, India, and Andrew Whitaker, a professor of physics at Queen's University Belfast in Northern Ireland, make no use of the published volumes of Einstein's papers and mention very little of the pertinent, specialized history-of-science literature on the subject. Nor did they do any research in the Albert Einstein Archives at the Hebrew University in Jerusalem. "Fifty years of conscious brooding" has left its traces in unpublished manuscripts, correspondence, and other documents, analysis of which would make for an interesting read. I should expect that such an account would put Einstein's response to the physics of his time in a broader historical context. But the authors are not historians, and their focus is not on Einstein as a historical figure.

Nevertheless, despite the misleading first part of its title, the book is serious, competent, and most engaging. Its declared aim is a reappraisal of Einstein's critical attitude toward quantum theory. The authors argue against the widely shared view that Einstein's refusal to accept the orthodox Copenhagen interpretation is merely an expression of a stubborn unwillingness to accept the results of modern physical research. Quite to the contrary, they argue, the case can be made that much of the most interesting, cutting-edge research in quantum physics today vindicates Einstein's critical insistence on questioning the conventional Copenhagen dogma. What they see as Einstein's crucial legacy is mostly the famous Einstein-Podolsky-Rosen incompleteness argument.

Home and Whitaker also discuss some of his earlier work and especially the famous Einstein–Bohr debate. They agree with historians and philosophers of science who recently have been debunking the myth of the grand victory of Niels Bohr and his followers in their standoff with Einstein. The authors evaluate Einstein's position on the basis of his published works and some of his published correspondence. Despite their not-so-much historical yet systematic interest, they give a fair characterization of his position, although their analysis of his realism as pragmatic seems excessively benign. A more detailed historical evaluation may have revealed his position to be more nuanced, one that also changed over time and was perhaps not always consistent.

The authors' historical claim that Einstein's critique of quantum theory was justifiable does not derive from an assessment of the physics of Einstein's day. It rests on identifying a line of development that leads from David Bohm and John Stewart Bell to today's research in quantum information theory, quantum computation, quantum cryptography, and efforts to test quantum mechanical effects on mesoscopic and macroscopic scales. In fact, the book's full strength unfolds in its later chapters, where the authors discuss recent developments in those fields in light of their earlier treatment of Einstein's criticisms. A crucial observation emphasized by the authors is that the ubiquitous notion of entanglement traced back to Einstein's earlier interventions is now being explored as a rich resource rather than as a stumbling block for the standard interpretation.

Home and Whitaker give expert overviews and brief characterizations of various nonstandard quantum interpretations, the development and current status of the field of quantum information theory, and attempts to bridge the quantum–classical divide. For the most part, they avoid equations. Nevertheless, the arguments require some prior knowledge of quantum theory. Each chapter offers many references to the relevant literature that will help students read further.

The reappraisal suggested in the book provides a fresh perspective on Einstein's work in light of researchers' current best understanding of quantum physics. It also justifies the authors' passionate plea for an "open spirit of tolerance." With their goals set between a rock and a hard place, between history and ongoing science, the authors have won my full support. I recommend *Einstein's Struggles with Quantum Theory* to physicists who are interested in their past and to historians and philosophers who are curious about today's quantum physics.

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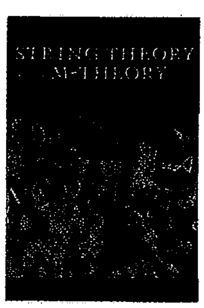
String Theory and M-Theory

A Modern Introduction

Katrin Becker, Melanie Becker, and John H. Schwarz
Cambridge U. Press, New York, 2007. $80.00 (739 pp.). ISBN 978-0-521-86069-7

It has been 40 years since Gabriele Veneziano wrote his celebrated scattering amplitude, which marked the beginning of string theory. In the intervening years, the theory has morphed into one of the most interesting fields of scientific study, providing new theoretical vistas in mathematics, quantum field theory, and the nature of black holes, and possible guideposts for physics beyond the standard model, such as supersymmetry and extra space dimensions. Those events were described in their masterful two volumes of *Superstring Theory* (Cambridge University Press, 1987) by Michael Green, John Schwarz, and Edward Witten. In 1998, Joseph Polchinski's *String Theory*, also a two-volume presentation from the same publisher, included the latest breakthroughs.



Today, Katrin Becker, Melanie Becker, and Schwarz have written *String Theory and M-Theory: A Modern Introduction*, a one-volume textbook that covers not only earlier progress in string theory but also the mind-boggling developments of the last decade: the emergence of 11-dimensional M-theory; the AdS/CFT (anti-de Sitter/conformal field theory) correspondence; flux compactification and moduli stabilization; black hole statistical mechanics; and the beginnings of string-based cosmologies. The work teams up one of the celebrated founding fathers of modern superstring theory with two much younger authors who have also contributed much to the field. The Beckers, sisters who are both physics professors at Texas A&M University, and Schwarz, the Harold Brown Professor of Theoretical Physics at Caltech, are eminently competent to present the complicated subjects. *String Theory and M-Theory* promises to become the new standard text.

The book is well written and covers a set of judiciously chosen topics. Compared with its predecessors, it has more pedagogical value. Each of its 12 chapters begins with a descriptive introduction, which is bound to be useful to those students and researchers, such as string phenomenologists, who need to understand the concepts without being burdened by technical details. Those preambles provide a road map for the sometimes confusing topics and give some sense of perspective to the necessarily technical presentations that follow. More significant, the technical material is supplemented by exercises that are well chosen to illustrate the most difficult concepts; though many have accompanying solutions, the more dedicated students will eagerly work through those that do not.

Graduate students with some training in mathematics and a degree of familiarity with quantum field theory will enjoy *String Theory and M-Theory*. In writing a self-contained text for the enormous and still-evolving subject area, the authors had to make compromises. One volume may not have sufficed to cover the developments of the past decade. Thus, important subjects, such as M-theory and the profound AdS/CFT connection, are not treated with a level of detail that will satisfy the most inquisitive readers. Explicit calculations, absent except in the exercises, would have further enhanced the pedagogical value of the book. Nevertheless, it is a welcome addition to the literature and will most likely be the required text for those physicists who intend to study the many facets of this fascinating subject. Further understanding of string theory is bound to produce more surprises. In the meantime, *String Theory and M-Theory* is *the* string textbook—at least until the next string revolution.

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Don't Try This at Home!

The Physics of Hollywood Movies

Adam Weiner
Kaplan, New York, 2007. $17.95 paper (264 pp.). ISBN 978-1-4195-9406-9

If there is one thing Adam Weiner's *Don't Try This at Home! The Physics of Hollywood Movies* has in abundance, it is style. Like an Indiana Jones movie, Weiner's prose moves at high speed from the very start, where he introduces for dissection the first cinematographic corpus, a well-known 2002 action film:

> In *XXX*, Xander Cage (how's that for a name?), played by Vin Diesel (how's that for a name?), is an extreme counter-culture rebel looking for adrenaline thrills while sticking it to "the man" whenever he can. He's tattooed, tough, and fearless.

Weiner later describes a particularly exciting section of the film:

> In *XXX*'s climactic scenes 25 and 27, Yorgi has just released the automated boat containing the toxic gas containers onto the Danube. It is traveling "80 mph at least" according to Vin Diesel, as he and Yelena frantically try to stay parallel with it while driving on the road adjacent to the river in their specially outfitted GTO. . . . Fortunately the car has been equipped with rocket launchers that the two heroes use to blast wooden crates and bales of hay out of their way so that they don't have to slow down much.

After a page of setting up the movie, Weiner, a physics teacher at the Bishop's School, a college preparatory school in La Jolla, California, moves on to a four-page exposition of one-dimensional kinematics, which can be used to judge the likelihood that the car will catch up to the boat. According to the blurb on its back cover, the book is supposed to teach film buffs and physics students alike the major topics found in