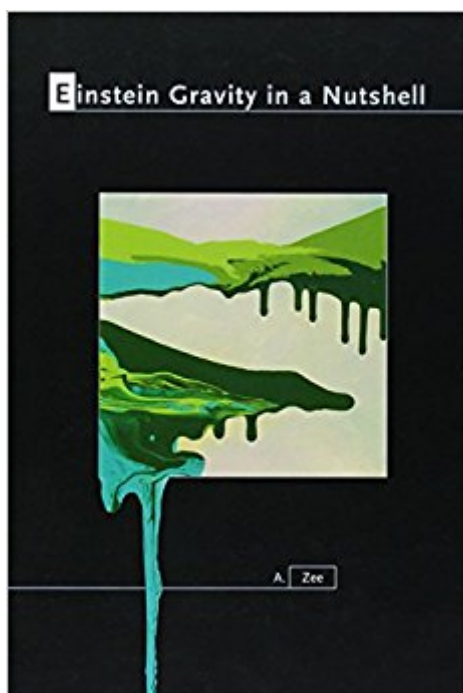


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# Einstein Gravity In A Nutshell



## Synopsis

This unique textbook provides an accessible introduction to Einstein's general theory of relativity, a subject of breathtaking beauty and supreme importance in physics. With his trademark blend of wit and incisiveness, A. Zee guides readers from the fundamentals of Newtonian mechanics to the most exciting frontiers of research today, including de Sitter and anti-de Sitter spacetimes, Kaluza-Klein theory, and brane worlds. Unlike other books on Einstein gravity, this book emphasizes the action principle and group theory as guides in constructing physical theories. Zee treats various topics in a spiral style that is easy on beginners, and includes anecdotes from the history of physics that will appeal to students and experts alike. He takes a friendly approach to the required mathematics, yet does not shy away from more advanced mathematical topics such as differential forms. The extensive discussion of black holes includes rotating and extremal black holes and Hawking radiation. The ideal textbook for undergraduate and graduate students, *Einstein Gravity in a Nutshell* also provides an essential resource for professional physicists and is accessible to anyone familiar with classical mechanics and electromagnetism. It features numerous exercises as well as detailed appendices covering a multitude of topics not readily found elsewhere.

Provides an accessible introduction to Einstein's general theory of relativity  
Guides readers from Newtonian mechanics to the frontiers of modern research  
Emphasizes symmetry and the Einstein-Hilbert action  
Covers topics not found in standard textbooks on Einstein gravity  
Includes interesting historical asides  
Features numerous exercises and detailed appendices  
Ideal for students, physicists, and scientifically minded lay readers  
Solutions manual (available only to teachers)

## Book Information

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## Customer Reviews

One of Choice's Outstanding Academic Titles for 2013"Zee writes in an informal, conversational style, displaying his extensive experience and close contacts with many undergraduate and graduate students."--Choice

"Einstein Gravity in a Nutshell is a remarkably complete and thorough textbook on general relativity, written in a refreshing and engaging style. Zee leads us through all the major intellectual steps that make what is surely one of the most profound and beautiful theories of all time. The book is enjoyable and informative in equal measure. Quite an achievement."--Pedro Ferreira, University of Oxford"Zee's new text on gravitation provides a wonderful introduction to Einstein's theory. Written at a level accessible to undergraduates, it prepares its readers for work at the research frontier, gently leading the reader to a modern and sophisticated understanding of the subject with a humorous, often conversational style. Providing broad coverage of the subject, including cosmology and black holes, it is an excellent complement to Hartle's book and good preparation for Carroll's."--Michael Dine, University of California, Santa Cruz"Einstein Gravity in a Nutshell is richly infused with the author's wit and wisdom, with a refreshing emphasis on concepts rather than mathematics. Zee's writing is characteristically insightful, humorous, irreverent, and accessible."--Andrew Hamilton, University of Colorado, Boulder

My favorite popular physics book happens to be Prof. Zee's own *An Old Man's Toy*. I found that book more enlightening than (the likewise excellent) books by Brian Greene or Michio Kaku, for example. *Toy* is infused with physical insight and clear writing. This unique textbook from Prof. Zee reads much like *Toy* but with all the added mathematics. Thus, it imparts that same physical insight but this time backed by the underlying mathematical and scientific details. The result is a textbook that's humorous, playful, and authoritative mixed with equal parts irreverence, verve, and gusto. Learning general relativity has never been so fun. And funny, I might add. There are lots of excellent textbooks on general relativity. Professor Zee's new offering differs from all of them, however, in that he takes a lighthearted approach to the subject without sacrificing rigor or thoroughness. Passages describing light following a least time principle because light isn't "stupid"

enough not to and dutifully informing us that "After Lagrange invented the Lagrangian, Hamilton invented the Hamiltonian" made me break out laughing. The book abounds with dry humor and witticisms. His introduction of the action principle is particularly mirthful. But for all the comedy, the book is thorough. One example is the treatment of Hawking radiation. It's as complete as I've seen in other relativity textbooks and even Raine and Thomas's textbook on specifically black holes. Another example is the emphasis on the action principle. For that Prof. Zee discusses the background variational calculus and derives in detail the familiar Euler-Lagrange equation; I mention this only because these steps are often omitted in books on more advanced subjects that assume knowledge of the action principle. There's also a discussion on the relativistic relationship between electricity and magnetism. Some electromagnetism texts, such as Purcell, Schwartz, or Ohanian, perform this derivation in one form or another (I happen to think this is how electromagnetism should be taught), but I haven't seen many general relativity texts step outside their usual confines to broach this subject. I suspect Dr. Zee did so because it beautifully illustrates the symmetry and unification of physics that he has eloquently written about previously. And the last 100 pages or so touch on peripheral topics found also in quantum field theory and string theory, such as Kaluza-Klein theory, Yang-Mills theory, branes, and twistors. A discussion on quantum gravity is included as well. A lot of this is speculative, but as Prof. Zee wryly, and funnily, asserts, textbooks "should not consist exclusively of material that has been carved in stone, or even worse, embalmed." Dr. Zee further demonstrates that the theory of gravity extends beyond the merely secular by thoughtfully providing a section that employs gravitational theorems to prove that Hades isn't on (or in) Earth. Or that if it is, it's not how conventional wisdom depicts it. This book truly has something for everyone, even those unfortunate souls doomed to perdition. Adding immensely to this book's charm are the analogies. That objects of different mass fall at the same rate can be shown easily enough mathematically, but Prof. Zee likens that fact to different airlines following the same flight path between Los Angeles and Taipei. So masterfully simple, yet I'd never thought of it that way before. The book is packed with similar insights and thought experiments that crystallize many of the concepts. Professor Zee also includes numerous interesting anecdotes and personal observations from the world of relativity, many of which are contained in the end-of-chapter notes. Whenever I came across a superscripted number I immediately paged to the chapter end to read that corresponding note. Those are as fascinating as the main text itself. The notes range from literature references to detailed excursions into topics off the beaten path to the just plain funny. They're not to be missed. Reading this textbook is like being regaled by that friendly, enthusiastic professor during a profound hallway conversation. I gleaned insight after insight, had several

forehead-slapping "Of course!" moments, and chuckled heartily at the humor. It was worth the month I had to wait for it to arrive. If you liked Prof. Zee's quantum field theory textbook, you'll enjoy this one even more. The words on the pages come alive, almost as if he were right there in the room lecturing to you. For self-study especially, as I'm doing, this book is ideal; and, likewise, students whose professors assign this textbook will be in for a fun semester. Whatever the occasion, Einstein Gravity In A Nutshell is a wonderful, worthy addition to the canon of general relativity books.

Einstein Gravity does a better job than I thought possible of conveying, in understandable ways, the complexities of General Relativity to novices who have at least a little calculus under their belt. The author clearly loves the subject and loves teaching it. His explanation of the basics includes stories about Galileo's ideas on the subject and the introductory material that Einstein included in his own book, *Relativity* -- but in modern terms and in more detail. The book runs the gamut from the introductory to the profound. I had to jump off somewhere in the middle, but was able to follow the gist of each chapter, and even felt at home reading the concluding paragraphs where the author describes the future enhancements to this, the most provocative idea in the history of science.

I'm a postdoctoral fellow at MIT in theoretical cosmology. I recently purchased a copy of this text, and I think it is my new favorite physics book. I was starting to feel a little bit burned out, especially after helping to teach the MIT general relativity course to some rather disinterested students last spring. The book is a reminder of how wonderful and amazing mechanics is and how GR makes it even more fun. The whimsy is much appreciated, as is the section on Galileo's thought experiment vs. spacetime diagrams! I also think it is compelling evidence for the idea that while the math may sometimes be complicated, the physics is both accessible and beautiful. I think an undergrad with a reasonable background in classical mechanics and intermediate electromagnetism would have a fun time with it. Beyond including discussions of the material that are quite different from other books, this book also includes topics that other ones don't. For example, I really appreciate the discussion about initial value problems. This week I'm giving a talk to Alan Guth's undergrads about the Faddeev-Jackiw technique for constraint reduction, and that chapter really helped me to focus my thoughts on the fundamentals that are important to draw out when discussing constraints. I'm excited Zee wrote this text. It's great! I was already a huge fan of QFT/Nut, but I think this one is even better. (I'm a relativist, so I may be biased!)

For those of us interested in GenRel, MTW remains the "gold standard" in my opinion, but it can be a daunting first text! For people who want to start one level lower, then graduate to MTW, this text is outstanding. Zee's explanations are clear and thorough and get the main concepts across with a minimum of pain. His approach is historical and thus logical. The only negative, in my opinion, is his "chatty" style in some places, which I personally find distasteful in a textbook. But as a way to begin the process of learning GenRel, this book will set the standard for years to come.

This is a college textbook, but easy enough to follow if your calculus is not rusty. Even if you skip some of the technical details, you can still get a lot out of it. The book is big and heavy, but the content is not as heavy as his Quantum Field Theory in a Nutshell.

Awesome book! A must have for any serious physics student!

The exposition of differential geometry is inadequate and even faulty in places. For example, he doesn't explain that 1-forms belong to the space dual to the tangent space -- this is basic stuff. The exposition is terse, with important omissions, and garbled. It's not even clear to me that he understands the math properly himself (which would not be surprising as he's a physicist). If you insist on using the book, use a proper differential geometry text as a supplement.

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