
General Relativity Workbook

Introduction to General Relativity
The Physics Book
An Introduction to Special and General Relativity
How Relative Is Relativity
A Concise Introduction to the Geometry of Relativity
Perspectives in Computation
Symmetries and Group Theory in Particle Physics
Big Ideas Simply Explained
A Basic Introduction
Relativity, Gravitation and Cosmology
An Introduction for Physicists
Differential Forms and the Geometry of General Relativity
Spacetime and Geometry
General Relativity
An Introduction to the Special Theory of Relativity
Gravity from the Ground Up
A General Relativity Workbook
Relativity
The Theoretical Minimum
A First Course in Loop Quantum Gravity
The Mechanics of Our Universe
Problem Book in Relativity and Gravitation
Gravity
An Introductory Guide to Gravity and General Relativity
A First Course in General Relativity
A Traveler's Guide to Spacetime
A Student's Manual for A First Course in General Relativity
A Student's Guide to General Relativity
The Mathematics of the Standard Model of Physics
An Introduction to Space-Time and Internal Symmetries
Introduction to Einstein's Theory of Relativity
An 8-year-old's Guide to Quantum Physics
General Relativity
A First Course in General Relativity
What You Need to Know to Start Doing Physics
Space-Time Algebra
Numerical Relativity
Solving Einstein's Equations on the Computer
Spacetime Physics

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"Wald's book is clearly the first textbook on general relativity with a totally modern point of view; and it succeeds very well where others are only partially successful. The book includes full discussions of many problems of current interest which are not treated in any extant book, and all these matters are considered with perception and understanding."—S. Chandrasekhar "A tour de force: lucid, straightforward, mathematically rigorous, exacting in the analysis of the theory in its physical aspect."—L. P. Hughston, Times Higher Education Supplement "Truly excellent. . . A sophisticated text of manageable size that will probably be read by every student of relativity, astrophysics, and field theory for years to come."—James W. York, Physics Today

The Physics Book Cambridge University Press

"General Relativity Without Calculus" offers a compact but mathematically correct introduction to the general theory of relativity, assuming only a basic knowledge of high school mathematics and physics. Targeted at first year undergraduates (and advanced high school students) who wish to learn Einstein's theory beyond popular science accounts, it covers the basics of special relativity, Minkowski space-time, non-Euclidean geometry, Newtonian gravity, the Schwarzschild solution, black holes and cosmology. The quick-paced style is balanced by over 75 exercises (including full solutions), allowing readers to test and consolidate their understanding.

An Introduction to Special and General Relativity Basic Books

This small book started a profound revolution in the development of mathematical physics, one which has reached many working physicists

already, and which stands poised to bring about far-reaching change in the future. At its heart is the use of Clifford algebra to unify otherwise disparate mathematical languages, particularly those of spinors, quaternions, tensors and differential forms. It provides a unified approach covering all these areas and thus leads to a very efficient 'toolkit' for use in physical problems including quantum mechanics, classical mechanics, electromagnetism and relativity (both special and general) – only one mathematical system needs to be learned and understood, and one can use it at levels which extend right through to current research topics in each of these areas. These same techniques, in the form of the 'Geometric Algebra', can be applied in many areas of engineering, robotics and computer science, with no changes necessary – it is the same underlying mathematics, and enables physicists to understand topics in engineering, and engineers to understand topics in physics (including aspects in frontier areas), in a way which no other single mathematical system could hope to make possible. There is another aspect to Geometric Algebra, which is less tangible, and goes beyond questions of mathematical power and range. This is the remarkable insight it gives to physical problems, and the way it constantly suggests new features of the physics itself, not just the mathematics. Examples of this are peppered throughout 'Space-Time Algebra', despite its short length, and some of them are effectively still research topics for the future. From the Foreword by Anthony Lasenby
How Relative Is Relativity Cambridge University Press
A working knowledge of Einstein's theory

of general relativity is an essential tool for every physicist today. This self-contained book is an introductory text on the subject aimed at first-year graduate students, or advanced undergraduates, in physics that assumes only a basic understanding of classical Lagrangian mechanics. The mechanics problem of a point mass constrained to move without friction on a two-dimensional surface of arbitrary shape serves as a paradigm for the development of the mathematics and physics of general relativity. After reviewing special relativity, the basic principles of general relativity are presented, and the most important applications are discussed. The final special topics section guides the reader through a few important areas of current research. This book will allow the reader to approach the more advanced texts and monographs, as well as the continual influx of fascinating new experimental results, with a deeper understanding and sense of appreciation.

A Concise Introduction to the Geometry of Relativity University of Chicago Press

Perspectives in Computation covers three broad topics: the computation process & its limitations; the search for computational efficiency; & the role of quantum mechanics in computation.

Perspectives in Computation

Springer Science & Business Media

The book aims to give a mathematical presentation of the theory of general relativity (that is, spacetime-geometry-based gravitation theory) to advanced undergraduate mathematics students. Mathematicians will find spacetime physics presented in the definition-theorem-proof format familiar to them. The given precise mathematical definitions of physical notions help

avoiding pitfalls, especially in the context of spacetime physics describing phenomena that are counter-intuitive to everyday experiences. In the first part, the differential geometry of smooth manifolds, which is needed to present the spacetime-based gravitation theory, is developed from scratch. Here, many of the illustrating examples are the Lorentzian manifolds which later serve as spacetime models. This has the twofold purpose of making the physics forthcoming in the second part relatable, and the mathematics learnt in the first part less dry. The book uses the modern coordinate-free language of semi-Riemannian geometry. Nevertheless, to familiarise the reader with the useful tool of coordinates for computations, and to bridge the gap with the physics literature, the link to coordinates is made through exercises, and via frequent remarks on how the two languages are related. In the second part, the focus is on physics, covering essential material of the 20th century spacetime-based view of gravity: energy-momentum tensor field of matter, field equation, spacetime examples, Newtonian approximation, geodesics, tests of the theory, black holes, and cosmological models of the universe. Prior knowledge of differential geometry or physics is not assumed. The book is intended for self-study, and the solutions to the (over 200) exercises are included.

Symmetries and Group Theory in Particle Physics Cambridge University Press

Differential Forms and the Geometry of General Relativity provides readers with a coherent path to understanding relativity. Requiring little more than calculus and some linear algebra, it helps readers learn just enough

differential geometry to grasp the basics of general relativity. The book contains two intertwined but distinct halves. Designed for advanced undergraduate or beginning graduate students in mathematics or physics, most of the text requires little more than familiarity with calculus and linear algebra. The first half presents an introduction to general relativity that describes some of the surprising implications of relativity without introducing more formalism than necessary. This nonstandard approach uses differential forms rather than tensor calculus and minimizes the use of "index gymnastics" as much as possible. The second half of the book takes a more detailed look at the mathematics of differential forms. It covers the theory behind the mathematics used in the first half by emphasizing a conceptual understanding instead of formal proofs. The book provides a language to describe curvature, the key geometric idea in general relativity.

Big Ideas Simply Explained OUP Oxford
 Vectors, tensors and functions --
 Manifolds, vectors and differentiation --
 Energy, momentum and Einstein's equations

A Basic Introduction Cambridge University Press

This textbook develops general relativity and its associated mathematics from a minimum of prerequisites, leading to a physical understanding of the theory in some depth.

Relativity, Gravitation and Cosmology
 Univ Science Books

A General Relativity Workbook Univ Science Books

An Introduction for Physicists

McGraw-Hill Science, Engineering & Mathematics

This text blends traditional introductory physics topics with an emphasis on

human applications and an expanded coverage of modern physics topics, such as the existence of atoms and the conversion of mass into energy. Topical coverage is combined with the author's lively, conversational writing style, innovative features, the direct and clear manner of presentation, and the emphasis on problem solving and practical applications.

Differential Forms and the Geometry of General Relativity Birkhäuser

Aimed at students and researchers entering the field, this pedagogical introduction to numerical relativity will also interest scientists seeking a broad survey of its challenges and achievements. Assuming only a basic knowledge of classical general relativity, the book develops the mathematical formalism from first principles, and then highlights some of the pioneering simulations involving black holes and neutron stars, gravitational collapse and gravitational waves. The book contains 300 exercises to help readers master new material as it is presented.

Numerous illustrations, many in color, assist in visualizing new geometric concepts and highlighting the results of computer simulations. Summary boxes encapsulate some of the most important results for quick reference. Applications covered include calculations of coalescing binary black holes and binary neutron stars, rotating stars, colliding star clusters, gravitational and magnetorotational collapse, critical phenomena, the generation of gravitational waves, and other topics of current physical and astrophysical significance.

Spacetime and Geometry University of Chicago Press

General relativity, which lies at the heart of contemporary physics, has recently

become the focus of a number of lively theoretical, experimental, and computational research programs. As a result, undergraduates have become increasingly excited to learn about the subject. A General Relativity Workbook is a textbook intended to support a one-semester upper division undergraduate course on general relativity. Through its unique workbook-based design, it enables students to develop a solid mastery of both the physics and the supporting tensor calculus by pushing (and guiding) them to work through the implications. Each chapter, which is designed to correspond to one class session, involves a short overview of the concepts without obscuring derivations or details, followed by a series of boxes that guide students through the process of working things out for themselves. This active-learning approach enables students to develop a more secure mastery of the material than more traditional approaches. More than 350 homework problems support further learning. This book more strongly emphasizes the physics than many of its competitors, and while it provides students a full grounding in the supporting mathematics (unlike certain other competitors), it introduces the mathematics gradually and in a completely physical context.

General Relativity Cambridge University Press

Second edition of a widely-used textbook providing the first step into general relativity for undergraduate students with minimal mathematical background.

An Introduction to the Special Theory of Relativity Cambridge University Press

Linguists routinely emphasise the primacy of speech over writing. Yet, most linguists have analysed spoken

language, as well as language in general, applying theories and methods that are best suited for written language. Accordingly, there is an extensive 'written language bias' in traditional and present day linguistics and other language sciences. In this book, this point is argued with rich and convincing evidence from virtually all fields of linguistics.

Gravity from the Ground Up

Macmillan

An essential resource for learning about general relativity and much more, from four leading experts. Important and useful to every student of relativity, this book is a unique collection of some 475 problems--with solutions--in the fields of special and general relativity, gravitation, relativistic astrophysics, and cosmology. The problems are expressed in broad physical terms to enhance their pertinence to readers with diverse backgrounds. In their solutions, the authors have attempted to convey a mode of approach to these kinds of problems, revealing procedures that can reduce the labor of calculations while avoiding the pitfall of too much or too powerful formalism. Although well suited for individual use, the volume may also be used with one of the modern textbooks in general relativity.

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The revised and updated 2nd edition of this established textbook provides a self-contained introduction to the general theory of relativity, describing not only the physical principles and applications of the theory, but also the mathematics needed, in particular the calculus of differential forms. Updated throughout, the book contains more detailed explanations and extended discussions of several conceptual points, and

strengthened mathematical deductions where required. It includes examples of work conducted in the ten years since the first edition of the book was published, for example the pedagogically helpful concept of a "river of space" and a more detailed discussion of how far the principle of relativity is contained in the general theory of relativity. Also presented is a discussion of the concept of the 'gravitational field' in Einstein's theory, and some new material concerning the 'twin paradox' in the theory of relativity. Finally, the book contains a new section about gravitational waves, exploring the dramatic progress in this field following the LIGO observations. Based on a long-established masters course, the book serves advanced undergraduate and graduate level students, and also provides a useful reference for researchers.

A General Relativity Workbook

Cambridge University Press

Einstein's theory of general relativity is a cornerstone of modern physics. It also touches upon a wealth of topics that students find fascinating – black holes, warped spacetime, gravitational waves, and cosmology. Now reissued by Cambridge University Press, this groundbreaking text helped to bring general relativity into the undergraduate curriculum, making it accessible to

virtually all physics majors. One of the pioneers of the 'physics-first' approach to the subject, renowned relativist James B. Hartle, recognized that there is typically not enough time in a short introductory course for the traditional, mathematics-first, approach. In this text, he provides a fluent and accessible physics-first introduction to general relativity that begins with the essential physical applications and uses a minimum of new mathematics. This market-leading text is ideal for a one-semester course for undergraduates, with only introductory mechanics as a prerequisite.

Relativity Cambridge University Press

More emphasis is placed on an intuitive grasp of the subject and calculational facility than on rigorous exposition in this introduction to general relativity for mathematics undergraduates or graduate physicists.

[The Theoretical Minimum](#) McGraw-Hill Science/Engineering/Math

This book provides an introduction to Einstein's general theory of relativity. A "physics-first" approach is adopted so that interesting applications come before the more difficult task of solving the Einstein equation. The book includes extensive coverage of cosmology, and is designed to allow readers to study the subject alone.

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