

Introduction To Special Relativity Robert Resnick

Writing a new book on the classic subject of Special Relativity, on which numerous important physicists have contributed and many books have already been written, can be like adding another epicycle to the Ptolemaic cosmology. Furthermore, it is our belief that if a book has no new elements, but simply repeats what is written in the existing literature, perhaps with a different style, then this is not enough to justify its publication. However, after having spent a number of years, both in class and research with relativity, I have come to the conclusion that there exists a place for a new book. Since it appears that somewhere along the way, mathem- ics may have obscured and prevailed to the degree that we tend to teach relativity (and I believe, theoretical physics) simply using “heavier” mathematics without the inspiration and the mastery of the classic physicists of the last century. Moreover current trends encourage the application of techniques in producing quick results and not tedious conceptual approaches resulting in long-lasting reasoning. On the other hand, physics cannot be done a' la carte stripped from philosophy, or, to put it in a simple but dramatic context A building is not an accumulation of stones! As a result of the above, a major aim in the writing of this book has been the distinction between the mathematics of Minkowski space and the physics of r- ativity. The book presents the theory of relativity as a unified whole. By showing that the concepts of this theory are interrelated to form a unified totality David Bohm supplements some of the more specialist courses which have tended to give students a fragmentary impression of the logical and conceptual nature of physics as a whole.

This book is written for high school and college students learning about special relativity for the first time. It will appeal to the reader who has a healthy level of enthusiasm for understanding how and why the various results of special relativity come about. All of the standard introductory topics in special relativity are covered: historical motivation, loss of simultaneity, time dilation, length contraction, velocity addition, Lorentz transformations, Minkowski diagrams, causality, Doppler effect, energy/momentum, collisions/decays, force, and 4-vectors. Additionally, the last chapter provides a brief introduction to the basic ideas of general relativity, including the equivalence principle, gravitational time dilation, and accelerating reference frames. The book features more than 100 worked-out problems in the form of examples in the text and solved problems at the end of each chapter. These problems, along with the discussions in the text, will be a valuable resource in any course on special relativity. The numerous examples also make this book ideal for self-study. Very little physics background is assumed (essentially none in the first half of the book). An intriguing aspect of special relativity is that it is challenging due to its inherent strangeness, as opposed to a heavy set of physics prerequisites. Likewise for the math prerequisite: calculus is used on a few occasions, but it is not essential to the overall flow of the book.

Examines general Cartesian coordinates, the cross product, Einstein's special theory of relativity, bases in general coordinate systems, maxima and minima of functions of two variables, line integrals, integral theorems, and more. 1963 edition.

A funny, insightful, and self-contained guide to Einstein's relativity theory and classical field theories--including electromagnetism Physicist Leonard Susskind and data engineer Art Friedman are back. This time, they introduce readers to Einstein's special relativity and Maxwell's classical field theory. Using their typical brand of real math, enlightening drawings, and humor, Susskind and Friedman walk us through the complexities of waves, forces, and particles by exploring special relativity and electromagnetism. It's a must-read for both devotees of the series and any armchair physicist who wants to improve their knowledge of physics' deepest truths.

Spacetime physics -- Physics in flat spacetime -- The mathematics of curved spacetime -- Einstein's geometric theory of gravity -- Relativistic stars -- The universe -- Gravitational collapse and black holes -- Gravitational waves -- Experimental tests of general relativity -- Frontiers An Introduction to the Standard Model of Particle Physics familiarizes readers with what is considered tested and accepted and in so doing, gives them a grounding in particle physics in general. Whenever possible, Dr. Mann takes an historical approach showing how the model is linked to the physics that most of us have learned in less challenging areas. Dr. Mann reviews special relativity and classical mechanics, symmetries, conservation laws, and particle classification; then working from the tested paradigm of the model itself, he: Describes the Standard Model in terms of its electromagnetic, strong, and weak components Explores the experimental tools and methods of particle physics Introduces Feynman diagrams, wave equations, and gauge invariance, building up to the theory of Quantum Electrodynamics Describes the theories of the Strong and Electroweak interactions Uncovers frontier areas and explores what might lie beyond our current concepts of the subatomic world Those who work through the material will develop a solid command of the basics of particle physics. The book does require a knowledge of special relativity, quantum mechanics, and electromagnetism, but most importantly it requires a hunger to understand at the most fundamental level: why things exist and how it is that anything happens. This book will prepare students and others for further study, but most importantly it will prepare them to open their minds to the mysteries that lie ahead. Ultimately, the Large Hadron Collider may prove the model correct, helping so many realize their greatest dreams ... or it might poke holes in the model, leaving us to wonder an even more exciting possibility: that the answers lie in possibilities so unique that we have not even dreamt of them.

[The Cambridge Companion to Einstein](#)

[Spacetime Physics](#)

[A Book of Essays on Individuality as Negation in Philosophy and the Arts](#)

[The Oxford Handbook of the History of Physics](#)

[A First Course in General Relativity](#)

[With Applications to Astrophysics](#)

[An Introduction to Particle Physics and the Standard Model](#)

[Fundamentals of Physics I](#)

[Special Relativity and Classical Field Theory](#)

Writing for the general reader or student, Wald has completely revised and updated this highly regarded work to include recent developments in black hole physics and cosmology. Nature called the first edition "a very readable and accurate account of modern relativity physics for the layman within the unavoidable constraint of almost no mathematics. . . . A well written, entertaining and authoritative book."

This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it. This work is in the public domain in the United States of America, and possibly other nations. Within the United States, you may freely copy and distribute this work, as no entity (individual or corporate) has a copyright on the body of the work. Scholars believe, and we concur, that this work is important enough to be preserved, reproduced, and made generally available to the public. To ensure a quality reading experience, this work has been proofread and republished using a format that seamlessly blends the original graphical elements with text in an easy-to-read typeface. We appreciate your support of the preservation process, and thank you for being an important part of keeping this knowledge alive and relevant.

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

The book opens with a description of the smooth transition from Newtonian to Einsteinian behaviour from electrons as their energy is progressively increased, and this leads directly to the relativistic expressions for mass, momentum and energy of a particle.

This text brings the challenge and excitement of modern relativity and cosmology at rigorous mathematical level within reach of advanced undergraduates and beginning graduates.

The foundations are thoroughly developed together with the required mathematical background from differential geometry developed in Part III. The author also discusses the tests of general relativity in detail, including binary pulsars, with much space is devoted to the study of compact objects, especially to neutron stars and to the basic laws of black-hole physics. This well-structured text and reference enables readers to easily navigate through the various sections as best matches their backgrounds and perspectives, whether mathematical, physical or astronomical. Very applications oriented, the text includes very recent results, such as the supermassive black-hole in our galaxy and first double pulsar system

Relativity is a triumph of the power of human thought and Einstein's greatest gift to mankind. It is a fascinating but difficult theory to understand. Mathematics is intimidating for a beginner. The popular books do not go into details of the subject and textbooks are just too hard for self-study. This book aims to bridge the gap between the two. The emphasis of this book is to explain the meaning and intuition behind concepts and mathematics. There is extensive use of analogies from daily life to develop visualization and intuition. This book is well suited for a beginner who has limited physics and mathematics background. The biggest barrier in learning relativity is the notation, which is a language onto itself. If the meaning behind notation is not clear, it's easy to get lost in the maze of indices used in relativity. This book tries to address the reason and meaning behind relativistic notation.

[Relativity Made Relatively Easy](#)

[Relativity](#)

[Special, General, and Cosmological](#)

[Predicting Motion](#)

[The Geometry of Special Relativity](#)

[The Theoretical Minimum](#)

[An Introduction to Mechanics](#)

[An Introduction with 200 Problems and Solutions](#)

[Meson Theory of Nuclear Forces](#)

"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

These fourteen essays by leading historians and philosophers of science introduce the reader to the work of Albert Einstein. Following an introduction that places Einstein's work in the context of his life and times, the essays explain his main contributions to physics in terms that are accessible to a general audience, including special and general relativity, quantum physics, statistical physics, and unified field theory. The closing essays explore the relation between Einstein's work and twentieth-century philosophy, as well as his political writings.

Written by two of the field's true pioneers, Spacetime Physics can extend and enhance coverage of speciality relativity in the classroom. This thoroughly up-to-date, highly accessible overview covers microgravity, collider accelerators, satellite probes, neutron detectors, radioastronomy, and pulsars. The chapter on general relativity with new material on gravity waves, black holes, and cosmology.

General Relativity is a beautiful geometric theory, simple in its mathematical formulation but leading to numerous consequences with striking physical interpretations: gravitational waves, black holes, cosmological models, and so on. This introductory textbook is written for mathematics students interested in physics and physics students interested in exact mathematical formulations (or for anyone with a scientific mind who is curious to know more of the world we live in), recent remarkable experimental and observational results which confirm the theory are clearly described and no specialised physics knowledge is required. The mathematical level of Part A is aimed at undergraduate students and could be the basis for a course on General Relativity. Part B is more advanced, but still does not require sophisticated mathematics. Based on Yvonne Choquet-Bruhat's more advanced text, General Relativity and the Einstein Equations, the aim of this book is to give with precision, but as simply as possible, the foundations and main consequences of General Relativity. The first five chapters from General Relativity and the Einstein Equations have been updated with new sections and chapters on black holes, gravitational waves, singularities, and the Reissner-Nordstrom and interior Schwarzschild solutions. The rigour behind this book will provide readers with the perfect preparation to follow the great mathematical progress in the actual development, as well as the ability to model, the latest astrophysical and cosmological observations. The book presents basic General Relativity and provides a basis for understanding and using the fundamental theory.

The Geometry of Special Relativity provides an introduction to special relativity that encourages readers to see beyond the formulas to the deeper geometric structure. The text treats the geometry of hyperbolas as the key to understanding special relativity. This approach replaces the ubiquitous symbol of most standard treatments with the appropriate hyperbolic trigonometric functions. In most cases, this not only simplifies the appearance of the formulas, but also emphasizes their geometric content in such a way as to make them almost obvious. Furthermore, many important relations, including the famous relativistic addition formula for velocities, follow directly from the appropriate trigonometric addition formulas. The book first describes the basic physics of special relativity to set the stage for the geometric treatment that follows. It then reviews properties of ordinary two-dimensional Euclidean space, expressed in terms of the usual circular trigonometric functions, before presenting a similar treatment of two-dimensional Minkowski space, expressed in terms of hyperbolic trigonometric functions. After covering special relativity again from the geometric point of view, the text discusses standard paradoxes, applications to relativistic mechanics, the relativistic unification of electricity and magnetism, and further steps leading to Einstein ' s general theory of relativity. The book also briefly describes the further steps leading to Einstein ' s general theory of relativity and then explores applications of hyperbola geometry to non-Euclidean geometry and calculus, including a geometric construction of the derivatives of trigonometric functions and the exponential function.

Presents a history of physics, examining the theories and experimental practices of the science.

Concise, well-written treatment of epochal theory of modern physics covers classical relativity and the relativity postulate, time dilation, the twin paradox, momentum and energy, particles of zero mass, electric and magnetic fields and forces and more. Only high school math needed. Replete with examples, ideal for self-study. Introduction. 70 illustrations.

[Neo-Aristotelian Perspectives on Contemporary Science](#)

[A Student's Manual for A First Course in General Relativity](#)

[Introduction to the Theory of Relativity](#)

[General Relativity](#)

[The Theory of the Big Bang and Black Holes](#)

[Special & General Relativity](#)

[General Relativity from A to B](#)

[Introduction to General Relativity, Black Holes, and Cosmology](#)

[Space, Time, and Gravity](#)

This book gives an excellent introduction to the theory of special relativity. Professor Resnick presents a fundamental and unified development of the subject with unusually clear discussions of the aspects that usually trouble beginners. He includes, for example, a section on the common sense of relativity. His presentation is lively and interspersed with historical, philosophical and special topics (such as the twin paradox) that will arouse and hold the reader's interest. You'll find many unique features that help you grasp the material, such as worked-out examples, summary tables, thought questions and a wealth of excellent problems. The emphasis throughout the book is physical. The experimental background, experimental confirmation of predictions, and the physical interpretation of principles are stressed. The book treats relativistic kinematics, relativistic dynamics, and relativity and electromagnetism and contains special appendices on the geometric representation of space-time and on general relativity. Its organization permits an instructor to vary the length and depth of his treatment and to use the book either with or following classical physics. These features make it an ideal companion for introductory courses.

This book is an introduction to hyperbolic and differential geometry that provides material in the early chapters that can serve as a textbook for a standard upper division course on hyperbolic geometry. For that material, the students need to be familiar with calculus and linear algebra and willing to accept one advanced theorem from analysis without proof. The book goes well beyond the standard course in later chapters, and there is enough material for an honors course, or for supplementary reading. Indeed, parts of the book have been used for both kinds of courses. Even some of what is in the early chapters would surely not be nec essay for a standard course. For example, detailed proofs are given of the Jordan Curve Theorem for Polygons and of the decomposability of poly gons into triangles, These proofs are included for the sake of completeness, but the results themselves are so believable that most students should skip the proofs on a first reading. The axioms used are modern in character and more "user friendly" than the traditional ones. The familiar real number system is used as an ingredient rather than appearing as a result of the axioms. However, it should not be thought that the geometric treatment is in terms of models: this is an axiomatic approach that is just more convenient than the traditional ones.

The Self and its Shadows is a book of multiply interrelated essays which explores the study of selfhood (subjectivity or personal identity), and more specifically of a variety of articulations (in philosophy, psychoanalysis and the arts) of the idea that selfhood is best conceived as a matter of non-self-identity. Philosophically, a sustained reading of the work of Nietzsche and Sartre is central to this project, although Wittgenstein is also fundamentalto its concerns. Within the arts, several essays examine various films whose themes intersect with those of the philosophers under study (including Hollywood melodramas, recent spy movies such as the Bournetrilogy and the latest incarnation of James Bond, and David Fincher's 'Benjamin Button'); Wagner's Ring cycle is a recurrent concern; and the novels of Kingsley Amis, J. M.Coetzee and David Foster Wallace are also prominent.

The physicist and humanitarian took his place beside the great teachers with the publication of Relativity: The Special and General Theory, Einstein's own popular translation of the physics that shaped our "truths" of space and time.

"This beautiful little book is certainly suitable for anyone who has had an introductory course in physics and even for some who have not."—Joshua N. Goldberg, Physics Today "An imaginative and convincing new presentation of Einstein's theory of general relativity. . . . The treatment is masterful, continual emphasis being placed on careful discussion and motivation, with the aim of showing how physicists think and develop their ideas."—Choice

Utilizing a mathematical level that requires only a brief introduction to the calculus, it provides a clear exposition of relativity in mechanics and electrodyamics without using matrices or tensors. Many confusing points are clarified: the effects of moving electric and magnetic fields, induced emf, the Faraday disk, the unipolar generator, the homopolar generator, the equivalence principle, the gravitational deflection of light, and others. Most important are the sharp insights into one of the great intellectual achievements of the century.

This book unfolds the subject of Relativity for undergraduate students of physics. It is intended to allow an undergraduate physics course to extend somewhat further and wider in this area than has traditionally been the case, while ensuring that the mainstream of students can handle the material. Introducing Lorentz invariants and four-vectors early on, but postponing tensor notation till it is needed, the aim is to make manageable what would otherwise beregarded as hard; to make derivations as simple as possible and physical ideas as transparent as possible.

[An Introduction to Special and General Relativity](#)

[The Special Theory of Relativity](#)

[Introducing Einstein's Relativity](#)

[Mechanics, Relativity, and Thermodynamics, Expanded Edition](#)

[Introduction to Hyperbolic Geometry](#)

[Introduction to Vector and Tensor Analysis](#)

[The Special and the General Theory](#)

[Introduction to Special Relativity](#)

[Gravitation](#)

[Publisher Description](#)

Predicting Motion presents the core ideas of Newtonian mechanics, starting from Newton's laws and the idea that changes in motion are predictable given the forces that cause them. Richly illustrated with questions and answers for self-assessment, it carefully introduces concepts, such as kinetics and potential energy, linear momentum, torque (the r

A beloved introductory physics textbook, now including exercises and an answer key, explains the concepts essential for thorough scientific understanding In this concise book, R. Shankar, a well-known physicist and contagiously enthusiastic educator, explains the essential concepts of Newtonian mechanics, special relativity, waves, fluids, thermodynamics, and statistical mechanics. Now in an expanded edition—complete with problem sets and answers for course use or self-study—this work provides an ideal introduction for college-level students of physics, chemistry, and engineering; for AP Physics students; and for general readers interested in advances in the sciences. The book begins at the simplest level, develops the basics, and reinforces fundamentals, ensuring a solid foundation in the principles and methods of physics.

Comprehensive coverage of special theory (frames of reference, Lorentz transformation, more), general theory (principle of equivalence, more) and unified theory (Weyl's gauge-invariant geometry, more.) Foreword by Albert Einstein.

The last two decades have seen two significant trends emerging within the philosophy of science: the rapid development and focus on the philosophy of the specialised sciences, and a resurgence of Aristotelian metaphysics, much of which is concerned with the possibility of emergence, as well as the ontological status and indispensability of dispositions and powers in science. Despite these recent trends, few Aristotelian metaphysicians have engaged directly with the philosophy of the specialised sciences. Additionally, the relationship between fundamental Aristotelian concepts—such as "hylomorphism", "substance", and "faculties"—and contemporary science has yet to receive a critical and systematic treatment. Neo-Aristotelian Perspectives on Contemporary Science aims to fill this gap in the literature by bringing together essays on the relationship between Aristotelianism and science that cut across interdisciplinary boundaries. The chapters in this volume are divided into two main sections covering the philosophy of physics and the philosophy of the life sciences. Featuring original contributions from distinguished and early-career scholars, this book will be of interest to specialists in analytical metaphysics and the philosophy of science.

[A Beginner's Introduction to Basic & Advanced Concepts](#)

[For the Enthusiastic Beginner](#)

[The Self and Its Shadows](#)

[An Introduction to the Special Theory of Relativity](#)

[Special Relativity](#)