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Gravity

Introduction to Special Relativity

A First Course in General Relativity

The Physical and Mathematical Foundations of the Theory of Relativity

Relativity

Einstein's General Theory of Relativity

General Relativity

Special and General Relativity

An Introduction to Mathematical Relativity

Relativity Made Relatively Easy

Introducing Einstein's Relativity

Introduction to Relativity

The Geometry of Spacetime

Einstein's General Theory of Relativity

Spacetime and Geometry

General Relativity

Spacetime Physics

Introduction to General Relativity

The Special Theory of Relativity

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OMB No. 3397460286810 edited by

NATHAN BAILEY

Gravity 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.

Introduction to Special Relativity Springer Science & Business Media

Introduction to Relativity is intended to teach physics and astronomy majors at the freshman, sophomore or upper-division levels how to think about special and general relativity in a fundamental, but accessible, way. Designed to render any reader a "master of relativity", everything on the subject is comprehensible and derivable from first principles. The book emphasizes problem

solving, contains abundant problem sets, and is conveniently organized to meet the needs of both student and instructor. **Simplicity:** the book teaches space and time in relativity in a physical fashion with minimal mathematics **Conciseness:** the book teaches relativity by emphasizing the basic simplicity of the principles at work **Visualization:** space-time diagrams (Minkowski) illustrate phenomena from simultaneity to the resolution of the twin paradox in a concrete fashion **Worked problems:** two chapters of challenging problems solved in several ways illustrate and teach the principles **Problem sets:** each chapter is accompanied by a full set of problems for the student that teach the principles and some new phenomena

A First Course in General Relativity Cambridge University Press

There is little doubt that Einstein's theory of relativity captures the imagination. Not only has it radically altered the way we view the universe, but the theory also has a considerable number of surprises in store. This is especially so in the three main topics of current interest that this book reaches, namely: black holes, gravitational waves, and cosmology. The main aim of this textbook is to provide students with a sound mathematical introduction coupled to an understanding of the physical insights needed to explore the subject. Indeed, the book follows Einstein in that it introduces the theory very much from a physical point of view. After introducing the special theory of relativity, the basic field equations of gravitation are derived and discussed carefully as a prelude to first solving them in simple cases and then exploring the three main areas of application. This new edition contains a substantial extension content that considers new and updated developments in the field. Topics include coverage of the advancement of observational cosmology, the detection of gravitational waves from colliding black holes and neutron stars, and advancements in modern cosmology. Einstein's theory of relativity is undoubtedly one of the greatest achievements of the human mind. Yet, in this book, the author makes it possible for students with a wide range of abilities to deal confidently with the subject. Based on both authors' experience teaching the subject this is achieved by breaking down the main arguments into a series of simple logical steps. Full details are provided in the text and the numerous exercises while additional insight is provided through the numerous diagrams. As a result this book makes an excellent course for any reader coming to the subject for the first time while providing a thorough understanding for any student wanting to go on to study the subject in depth

The Physical and Mathematical Foundations of the Theory of Relativity Springer Nature

General relativity is now an essential part of undergraduate and graduate courses in physics, astrophysics and applied mathematics. This simple, user-friendly introduction to relativity is ideal for a first course in the subject. Beginning with a comprehensive but simple review of special relativity, the book creates a framework from which to launch the ideas of general relativity. After describing the basic theory, it moves on to describe important applications to astrophysics, black hole physics, and cosmology. Several worked examples, and numerous figures and images, help students appreciate the underlying concepts. There are also 180 exercises which test and develop students' understanding of the subject. The textbook presents all the necessary information and discussion for an elementary approach to relativity. Password-protected solutions to the exercises are available to instructors at www.cambridge.org/9780521735612.

Relativity Oxford University Press

This book takes a historical approach to Einstein's General Theory of Relativity and shows the importance that geometry has to the theory. Starting from simpler and more general considerations, it goes on to detail the latest developments in the field and considers several cutting-edge research areas. It discusses Einstein's theory from a geometrical and a field theoretic viewpoint, before moving on to address gravitational waves, black holes and cosmology.

Einstein's General Theory of Relativity Spacetime and Geometry

An accessible introductory textbook on general relativity, covering the theory's foundations, mathematical formalism and major applications.

General Relativity Springer Nature

This book is based on a set of 18 class-tested lectures delivered to fourth-year physics undergraduates at Griffith University in Brisbane, and the book presents new discoveries by the Nobel-prize winning LIGO collaboration. The author begins with a review of special relativity and tensors and then develops the basic elements of general relativity (a beautiful theory that unifies special relativity and gravitation via geometry) with applications to the gravitational deflection of light, global positioning systems, black holes, gravitational waves, and cosmology. The book provides readers with a solid understanding of the underlying physical concepts; an ability to appreciate and in many cases derive important applications of the theory; and a solid grounding for those wishing to pursue their studies further. *General Relativity: An Introduction to Black Holes, Gravitational Waves, and Cosmology* also connects general relativity with broader topics. There is no doubt that general relativity is an active and exciting field of physics, and this book successfully transmits that excitement to readers.

SPECIAL AND GENERAL RELATIVITY

Springer Science & Business Media

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 ground-breaking 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.

AN INTRODUCTION TO MATHEMATICAL RELATIVITY

Routledge

A straightforward, enjoyable guide to the mathematics of Einstein's relativity To really understand Einstein's theory of relativity – one of the cornerstones of modern physics – you have to get to grips with the underlying mathematics. This self-study guide is aimed at the general reader who is motivated to tackle that not insignificant challenge. With a user-friendly style, clear step-by-step

mathematical derivations, many fully solved problems and numerous diagrams, this book provides a comprehensive introduction to a fascinating but complex subject. For those with minimal mathematical background, the first chapter gives a crash course in foundation mathematics. The reader is then taken gently by the hand and guided through a wide range of fundamental topics, including Newtonian mechanics; the Lorentz transformations; tensor calculus; the Einstein field equations; the Schwarzschild solution (which gives a good approximation of the spacetime of our Solar System); simple black holes, relativistic cosmology and gravitational waves. Special relativity helps explain a huge range of non-gravitational physical phenomena and has some strangely counter-intuitive consequences. These include time dilation, length contraction, the relativity of simultaneity, mass-energy equivalence and an absolute speed limit. General relativity, the leading theory of gravity, is at the heart of our understanding of cosmology and black holes. "I must observe that the theory of relativity resembles a building consisting of two separate stories, the special theory and the general theory. The special theory, on which the general theory rests, applies to all physical phenomena with the exception of gravitation; the general theory provides the law of gravitation and its relations to the other forces of nature." – Albert Einstein, 1919 Understand even the basics of Einstein's amazing theory and the world will never seem the same again. Contents: Preface Introduction 1 Foundation mathematics 2 Newtonian mechanics 3 Special relativity 4 Introducing the manifold 5 Scalars, vectors, one-forms and tensors 6 More on curvature 7 General relativity 8 The Newtonian limit 9 The Schwarzschild metric 10 Schwarzschild black holes 11 Cosmology 12 Gravitational waves Appendix: The Riemann curvature tensor Bibliography Acknowledgements January 2019. This third edition has been revised to make the material even more accessible to the enthusiastic general reader who seeks to understand the mathematics of relativity.

Relativity Made Relatively Easy Springer

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

Introducing Einstein's Relativity World Scientific Publishing Company

"This book contains a tremendous amount of information for its size. The discussions are clear and to the point... Any teacher on this subject should seriously consider as a textbook." -- The Physicist Oxford University Press

This primer brilliantly exposes concepts related to special and general relativity for the absolute beginner. It can be used either as an introduction to the subject at a high school level or as a useful compass for undergraduates who want to move the first steps towards Einstein's theories. The book is enhanced throughout with many useful exercises and beautiful illustrations to aid understanding. The topics covered include: Lorentz transformations, length contraction and time dilation, the twin paradox (and other paradoxes), Minkowski spacetime, the Einstein equivalence principle, curvature of space and spacetime, geodesics, parallel transport, Einstein's equations of general relativity, black holes, wormholes, cosmology, gravitational waves, time machines, and much more.

Introduction to Relativity Springer Science & Business Media

This book introduces the general theory of relativity and includes applications to cosmology. The book provides a thorough introduction to tensor calculus and curved manifolds. After the necessary

mathematical tools are introduced, the authors offer a thorough presentation of the theory of relativity. Also included are some advanced topics not previously covered by textbooks, including Kaluza-Klein theory, Israel's formalism and branes. Anisotropic cosmological models are also included. The book contains a large number of new exercises and examples, each with separate headings. The reader will benefit from an updated introduction to general relativity including the most recent developments in cosmology.

The Geometry of Spacetime Macmillan

This book provides a concise introduction to both the special theory of relativity and the general theory of relativity. The format is chosen to provide the basis for a single semester course which can take the students all the way from the foundations of special relativity to the core results of general relativity: the Einstein equation and the equations of motion for particles and light in curved spacetime. To facilitate access to the topics of special and general relativity for science and engineering students without prior training in relativity or geometry, the relevant geometric notions are also introduced and developed from the ground up. Students in physics, mathematics or engineering with an interest to learn Einstein's theories of relativity should be able to use this book already in the second semester of their third year. The book could also be used as the basis of a graduate level introduction to relativity for students who did not learn relativity as part of their undergraduate training.

Einstein's General Theory of Relativity Alpha Edition

An introduction to Einstein's general theory of relativity, this work is structured so that interesting applications, such as gravitational lensing, black holes and cosmology, can be presented without the readers having to first learn the difficult mathematics of tensor calculus.

Spacetime and Geometry Cambridge University Press

"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

General Relativity Cambridge University Press

Hermann Minkowski recast special relativity as essentially a new geometric structure for spacetime. This book looks at the ideas of both Einstein and Minkowski, and then introduces the theory of frames, surfaces and intrinsic geometry, developing the main implications of Einstein's general relativity theory.

Spacetime Physics JHU Press

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 epicyle 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, mathematics 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 *à 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 relativity.

[Introduction to General Relativity](#) Morgan & Claypool Publishers

This unique textbook offers a mathematically rigorous presentation of the theory of relativity, emphasizing the need for a critical analysis of the foundations of general relativity in order to best study the theory and its implications. The transitions from classical mechanics to special relativity and then to general relativity are explored in detail as well, helping readers to gain a more profound and nuanced understanding of the theory as a whole. After reviewing the fundamentals of differential geometry and classical mechanics, the text introduces special relativity, first using the

physical approach proposed by Einstein and then via Minkowski’s mathematical model. The authors then address the relativistic thermodynamics of continua and electromagnetic fields in matter – topics which are normally covered only very briefly in other treatments – in the next two chapters. The text then turns to a discussion of general relativity by means of the authors’ unique critical approach, underlining the difficulty of recognizing the physical meaning of some statements, such as the physical meaning of coordinates and the derivation of physical quantities from those of space-time. Chapters in this section cover the model of space-time proposed by Schwarzschild; black holes; the Friedman equations and the different cosmological models they describe; and the Fermi-Walker derivative. Well-suited for graduate students in physics and mathematics who have a strong foundation in real analysis, classical mechanics, and general physics, this textbook is appropriate for a variety of graduate-level courses that cover topics in relativity. Additionally, it will interest physicists and other researchers who wish to further study the subtleties of these theories and understand the contemporary scholarly discussions surrounding them.

THE SPECIAL THEORY OF 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.

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