Einsteins General Relativity Theory Gravity As Dummies

Explore spectacular advances in contemporary physics with this unique celebration of the centennial of Einstein's discovery of general relativity.

An annotated facsimile edition of Einstein's handwritten manuscript on the foundations of general relativity This richly annotated facsimile edition of "The Foundation of General Relativity" introduces a new generation of readers to Albert Einstein's theory of gravitation. Written in 1915, this remarkable document is a watershed in the history of physics and an enduring testament to the elegance and precision of Einstein's thought. Presented here is a beautiful facsimile of Einstein's original handwritten manuscript, along with its English translation and an insightful page-by-page commentary that places the work in historical and scientific context. Hanoch Gutfreund and Jürgen Renn's concise introduction traces Einstein's intellectual odyssey from special to general relativity, and their essay "The Charm of a Manuscript" provides a delightful meditation on the varied afterlife of Einstein's text. Featuring a foreword by John Stachel, this handsome edition also includes a biographical glossary of the figures discussed in the book, a comprehensive bibliography, suggestions for further reading, and numerous photos and illustrations throughout.

Here it is, in a nutshell: the history of one genius's most crucial work – discoveries that were to change the face of modern physics. In the early 1900s, Albert Einstein formulated two theories that would forever change the landscape of physics: the Special Theory of Relativity and the General Theory of Relativity. Respected American academic Professor Tai Chow tells us the story of these discoveries. He details the basic ideas of Einstein, including his law of gravitation. Deftly employing his inimitable writing style, he goes on to explain the physics behind black holes, weaving into his account an explanation of the structure of the universe and the science of cosmology.

This classic text and reference monograph applies modern differential geometry to general relativity. A brief mathematical introduction to gravitational curvature, it emphasizes the subject's geometric essence and stresses the global aspects of cosmology. Suitable for independent study as well as for courses in differential geometry, relativity, and cosmology. 1979 edition.

An Introduction to General Relativity and Cosmology

With Modern Applications in Cosmology

This Way to the Universe

Introduction to General Relativity

Gravity, Black Holes, and the Very Early Universe

Gravity Explained

A History of the Multiverse and the Quest to Understand the Cosmos

November 2015 was the centennial of Einstein's theory of general relativity, which is the current reigning theory on gravity. In September 14, 2015, the twin Laser Interferometer Gravitational-wave Observatory (LIGO) detectors "supposedly" detected the gravitational waves. The discovery was announced on February 11, 2016. Soon enough, the discovery of the gravitational waves was awarded the Special Breakthrough in Fundamental Physics on May 2016 (probably setting it up for a nomination for the Nobel Prize in Physics). What is wrong with the detection of the gravitational waves? Physicists had failed in unifying general relativity and quantum mechanics, and there is no solution around it. Why is this so? Because general relativity is wrong. In this book, it is shown that the understanding of inertia of Galileo, Descartes, and Newton passed down to Einstein was wrong. Likewise, Einstein's relativity was wrong. (Galileo did not established the idea of relativity.) And so, how can there be gravitational waves when the foundation of general relativity is wrong? This book presents the following coherent theories: theory of everything, quark theory (structure of quarks inside the proton and neutron), new model of an atom (structure of an atom), charge theory, mass theory (compare the theory of the Higgs mechanism), general theory of gravity (overthrow general relativity), theory of inertia (replace the existing understanding of inertia), quantum gravity theory, standard model (revised and with the inclusion of gravity), hydrogen origin theory of the universe (overthrow and replace the Big Bang theory). The following theories and ideas were overthrown: Big Bang theory, cosmic background radiation (as the "ember" of the Big Bang theory), expansion and accelerating expansion of the universe, the idea of the dominance of matter over antimatter, dark matter and dark energy (explained as "aspects" of gravity), inertia (old understanding), relativity, special relativity (principle of relativity, time dilation, etc.), general relativity (gravitational lensing, gravitational waves, etc.), charge parity (charge parity symmetry and charge parity violation), Higgs mechanism (Higgs field and Higgs boson), and string theory.

The General Theory of Relativity: A Mathematical Exposition will serve readers as a modern mathematical introduction to the general theory of relativity. Throughout the book, examples, worked-out problems, and exercises (with hints and solutions) are furnished. Topics in this book include, but are not limited to: tensor analysis the special theory of relativity the general theory of relativity and Einstein's field equations spherically symmetric solutions and experimental confirmations static and stationary space-time domains black holes cosmological models algebraic classifications and the Newman-Penrose equations the coupled Einstein-Maxwell-Klein-Gordon equations appendices covering mathematical supplements and special topics Mathematical rigor, yet very clear presentation of the topics make this book a unique text for both university students and research scholars. Anadijiban Das has taught courses on Relativity Theory at The University College of Dublin, Ireland, Jadavpur University, India, Carnegie-Mellon University, USA, and Simon Fraser University, Canada. His major areas of research include, among diverse topics, the mathematical aspects of general relativity theory. Andrew DeBenedictis has taught courses in Theoretical Physics at Simon Fraser University, Canada, and is also a member of The Pacific Institute for the Mathematical Sciences. His research interests include quantum gravity, classical gravity, and semi-classical gravity.

Albert Einstein, a Nobel laureate, has changed the world with his research and theories. He is regarded as the founder of modern physics. Besides 'Relativity', he worked on Photoelectric effect, Brownian motion, Special relativity, and Mass-Energy equivalence (E=mc2). They reformed the views on time, space and matter. Allert Einstein developed the general theory of 'Relativity'. He published 'Relativity: The Special and the General Theory' in German. Its first English translation was published in 1920. The book deals with the special theory of relativity, the general theory of relativity, and the considerations on the universe as a whole The book gives an exact insight into the theory of Relativity. It covers, the system of Co-ordinates; The Lorentz Transformation; The experiment of Fizeau; Minkowski's four dimensional space; The Gravitational Field; Gaussian Co-ordinates; The structure of space, and lot many other scientific concepts thus will be highly beneficial to the Readers. A must have book for everyone related to modern physics.

An ideal introduction to Einstein's general theory of relativity 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)

The Special and General Theory

Relativity

One Big Idea Forever Changed How We Understand the Universe

Gravitation

General Relativity and Gravitation

Einstein's Theory of Relativity

The Science and History of Gravitational Waves

The Nobel Prize-winning physicist presents his views on the special and general theory of relativity and the universe as a whole, in an accessible introduction to his seminal theories, written for the non-scientist.

An astrophysicist offers an entertaining introduction to Einstein's theories, explaining how well they have held up to rigorous testing over the years, and even describing the amazing phenomena readers would actually experience if they took a trip through a black hole.

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.

From Science News comes a captivating anthology of articles exploring the concept of gravity and Albert Einstein's enduring influence on the way humans understand it. From the ancient Greeks to Galileo to Sir Isaac Newton, gravity has long fascinated scientists and laypeople alike. One of the most mysterious forces in the universe, gravity as a theory has developed and changed over the centuries, but no single person has had as much to do with its evolution, and our understanding, as Albert Einstein. This collection of articles from the Science News archive looks at Einstein's development of the general theory of relativity and considers its impact. Thanks to his revisions of Newton's theories, we have come to predict and understand phenomena such as gravitational waves, black holes, and the expansion of the universe. But Einstein did not just provide explanations—his work has raised new questions that scientists continue to investigate today. Since 1921, Society for Science & the Public has facilitated global understanding of important scientific discoveries and issues. Since the first publication of the Science News-Letter in 1922, they have grown their audience to millions of readers each year. Now, Science News exposes new readers to thrilling concepts and innovative theories in Einstein's Gravity.

An Introduction to Einstein's General Relativity

Gravitation and Inertia

The Curious History of Relativity

Gravity at Work and Play

On Gravity

An Intuitive Introduction to Einstein's Ideas, and Why They Matter

Relativity: The Special and General Theory

Student-friendly, well illustrated textbook for advanced undergraduate and beginning graduate students in physics and mathematics.

Einstein's general theory of relativity is introduced in this advanced undergraduate textbook. Without an over emphasis on the difficult mathematics of tensor analysis, the book presents the curved spacetime theory of gravitation. The phenomena of gravitational light deflection, the precession of a planet's orbit, and black holes are discussed with technical detail. The book has an extensive treatment of cosmology from primordial inflation, cosmic microwavebackground to the dark energy that propels an accelerating universe. The book is the undergraduate edition of the author's previous work, Relativity, Gravitation and Cosmology: A Basic Introduction,published as part of the Oxford Master Series in Physics. This college edition concentrates on the core elements of the subject making it suitable for a one-semester course at the undergraduate level. It can also serve as an accessible introduction to general relativity and cosmology for those readers who want to study the subject on their own.

This book, suitable for interested post-16 school pupils or undergraduates looking for a supplement to their course text, develops our modern view of space-time and its implications in the theories of gravity and cosmology. While aspects of this topic are inevitably abstract, the book seeks to ground thinking in observational and experimental evidence where possible. In addition, some of Einstein's philosophical thoughts are explored and contrasted with our modern views. Written in an accessible yet rigorous style, Jonathan Allday, a highly accomplished writer, brings his trademark clarity and engagement to these fascinating subjects, which underpin so much of modern physics. Features: Restricted use of advanced mathematics, making the book suitable for post-16 students and undergraduates Contains discussions of key modern developments in quantum gravity, and the latest developments in the field, including results from the Laser Interferometer Gravitational-Wave Observatory (LIGO) Accompanied by appendices on the CRC Press website featuring detailed mathematical arguments for key derivations

GravityAn Introduction to Einstein's General RelativityPearson

The Ultimate Key to the Cosmos

A College Course on Relativity and Cosmology

A Rigorous Introduction for the Mathematically Untrained

How Einstein's Theory of Gravity Was Lost and Found Again

Introduction to Einstein's Theory of Relativity

Theory of Gravity

The Road to Relativity

This richly illustrated book is unique in bringing Einstein's relativity to a higher level for the non-specialist than has ever been attempted before, using nothing more than grade-school algebra. Bondi's approach with spacetime diagrams is simplified and expanded, clarifying the famous asymmetric aging-of-twins paradox. Einstein's theory of gravity, general relativity, is simplified for the reader using spacetime diagrams. The theory is applied to important topics in physics such as gravitational waves, gravitational collapse and black holes, time machines, the relationship to the quantum world, galactic motions and cosmology.

The theory of relativity, explained by the greatest mind of the 20th century. Albert Einstein discusses the special and general theories of relativity, and the core concepts of modern cosmology, including time dilation, the spacetime continuum, and the energy-mass relationship, in simple non-mathematical terms.

Gravity causes an apple to fall to the ground and keeps the moon in orbit around Earth, but it can also trap light for infinity in a dying star and ripple across the cosmos carrying the news of a massive collision between two distant black holes. With accessible language and breathtaking NASA images, students will explore the theory of gravity, from Newton's law of universal gravitation to Einstein's general relativity and beyond. This book supports the Next Generation Science Standards' emphasis on scientific collection and analysis of data and evidence-based theories by discussing the theoretical models scientists devise to describe gravity and the real-world experiments they use to test them.

Black holes may obliterate most things that come near them, but they saved the theory of general relativity. Einstein's theory was quickly accepted as the true theory of gravity after its publication in 1915, but soon took a back seat in physics to quantum mechanics and languished for decades on the blackboards of mathematicians. Not until the existence of black holes by Stephen Hawking and Roger Penrose in the 1960s, after Einstein's death, was the theory revived. Almost one hundred years after general relativity replaced Newton's theory of gravitation, The Curious History of Relativity tells the story of both events surrounding general relativity and the techniques employed by Einstein and the relativists to construct, develop, and understand his almost impenetrable theory. Jean Eisenstaedt, one of the world's leading experts on the subject, also discusses the theory's place in the evolution of twentieth-century physics. He describes the main stages in the development of general relativity: its beginnings, its strange crossing of the desert during Einstein's lifetime while under heated criticism, and its new life from the 1960s on, when it became vital to the understanding of black holes and the observation of exotic objects, and, eventually, to the discovery of the accelerating universe. We witness Einstein's construction of his theory, as well as the work of his fascinated, discouraged, and enthusiastic colleagues--physicists, mathematicians, and astronomers. Written with flair, The Curious History of Relativity poses--and answers--the difficult questions raised by Einstein's magnificent intellectual feat.

Gravity

The Daring Expeditions that Changed How We Look at the Universe

Modifications of Einstein's Theory of Gravity at Large Distances

From Newton's Attractive Gravity to the Repulsive Gravity of Vacuum Energy

The History and Meaning of Einstein's "The Foundation of General Relativity", Featuring the Original Manuscript of Einstein's Masterpiece

The General Theory of Relativity

A Centennial Perspective

This is the only book on the subject of group theory and Einstein's theory of gravitation. It contains an extensive discussion on general relativity from the viewpoint of group theory and gauge fields. It also puts together in one volume many scattered, original works, on the use of group theory in general relativity theory.There are twelve chapters in the book. The first six are devoted to rotation and Lorentz groups, and their representations. They include the spinor representation as well as the infinite-dimensional representations. The other six chapters deal with the application of groups -particularly the Lorentz and the SL(2,C) groups — to the theory of general relativity. Each chapter is concluded with a set of problems.The topics covered range from the fundamentals of general relativity theory, its formulation as an SL(2,C) gauge theory, to exact solutions of the Einstein gravitational field equations. The important Bondi-Metzner-Sachs group, and its representations, conclude the book. The entire book is self-contained in both group theory and general relativity theory, and no prior knowledge of either is assumed.The subject of this book constitutes a relevant link between field theoreticians and general relativity theoreticians, who usually work rather independently of each other. The treatise is highly topical and of real interest to theoretical physicists, general relativists and applied mathematicians. It is invaluable to graduate students and research workers in quantum field theory, general relativity and elementary particle theory.

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. Until now, it has not been included in the curriculum of many undergraduate physics courses because the required math is too advanced. The aim of this ground-breaking new text is to bring general relativity into the undergraduate curriculum and make this fundamental theory accessible to virtually all physics majors. Using a "physics first" approach to the subject, renowned relativist James Hartle provides a fluent and accessible introduction that uses a minimum of new mathematics and illustrates a wealth of applications. Recognizing that there is typically not enough time in a short introductory course for the traditional, math-first, approach to the subject, Hartle presents a physics-first introduction to general relativity that begins with the essential physical applications.

A clear, plain-English guide to this complex scientific theory String theory is the hottest topic in physics right now, with books on the subject (pro and con) flying out of the stores. String Theory For Dummies offers an accessible introduction to this highly mathematical "theory of everything," which posits ten or more dimensions in an attempt to explain the basic nature of matter and energy. Written for both students and people interested in science, this guide explains concepts, discusses the string theory's hypotheses and predictions, and presents the math in an approachable manner. It features in-depth examples and an easy-to-understand style so that readers can understand this controversial, cutting-edge theory.

Einstein's theory of general relativity is a theory of gravity and, as in the earlier Newtonian theory, much can be learnt about the character of gravitation and its effects by investigating particular idealised examples. This book describes the basic solutions of Einstein's equations with a particular emphasis on what they mean, both geometrically and physically. Concepts such as big bang and big crunch-types of singularities, different kinds of horizons and gravitational waves, are described in the context of the particular space-times in which they naturally arise. These notions are initially introduced using the most simple and symmetric cases. Various important coordinate forms of each solution are presented, thus enabling the global structure of the corresponding space-time and its other properties to be analysed. The book is an invaluable resource both for graduate students and academic researchers working in gravitational physics.

A Theoretical Physicist's Journey to the Edge of Reality

String Theory For Dummies

Einstein's Relativity

Einstein Was Right

Proving Einstein Right

Einstein's Gravity

Einstein's Universe

In the last few years modified gravity theories have been proposed as extensions of Einstein's theory of gravity. Their main motivation is to explain the latest cosmological and astrophysical data on dark energy and dark matter. The study of general relativity at small scales has already produced important results (cf e.g. LNP 863 Quantum Gravity and Quantum Cosmology) while its study at large scales is challenging because recent and upcoming observational results will provide important information on the validity of these modified theories. In this volume, various aspects of modified gravity at large scales will be discussed: high-curvature gravity theories; general scalar-tensor theories; Galileon theories and their cosmological applications; F(R) gravity theories; massive, new massive and topologically massive gravity; Chern-Simons modifications of general relativity (including holographic variants) and higher-spin gravity theories, to name but a few of the most important recent developments. Edited and authored by leading researchers in the field and cast into the form of a multi-author textbook at postgraduate level, this volume will be of benefit to all postgraduate students and newcomers from neighboring disciplines wishing to find a comprehensive guide for their future research.

In his conversational style, Anthony Zee examines the nature of gravity and its role in our universe. Zee starts from a birthday gift that Albert Einstein received on his seventy-sixth birthday that worked on the main principle in his theory of gravity. From there Zee leads the reader through the implications of Einstein's theory and its influence on modern physics. Einstein's Universe in a witty and accessible style also examines how the theory of gravity has shaped our understanding of how the universe began, the development of stars and galaxies, and the nature of space itself. The new Oxford edition will include a new afterword by the author that will bring the subject matter up to date.

Semi-technical account includes a review of classical physics (origin of space and time measurements, Ptolemaic and Copernican astronomy, laws of motion, inertia, more) and of Einstein's theories of relativity.

A thrilling adventure story chronicling the perilous journey of the scientists who set out to prove the theory of relativity--the results of which catapulted Albert Einstein to fame and forever changed our understanding of the universe. In 1911, a relatively unknown physicist named Albert Einstein published his preliminary theory of gravity. But it hadn't been tested. To do that, he needed a photograph of starlight as it passed the sun during a total solar eclipse. So began a nearly decade-long quest by seven determined astronomers from observatories in four countries, who traveled the world during five eclipses to capture the elusive sight. Over the years, they faced thunderstorms, the ravages of a world war, lost equipment, and local superstitions. Finally, in May of 1919, British expeditions to northern Brazil and the island of Príncipe managed to photograph the stars, confirming Einstein's theory. At its heart, this is a story of frustration, faith, and ultimate victory--and of the scientists whose efforts helped build the framework for the big bang theory, catapulted Einstein to international fame, and shook the foundation of physics.

Group Theory & General Relativity

Gravity: Pearson New International Edition

Einstein's Theory of Spacetime, Time Dilation, Gravity, and Cosmology

An Introduction to Einstein's Theory

Einstein's Theory

What Is Relativity?

General Theory of Gravity, Quantum Gravity Theory, and Hydrogen Origin Theory of the Universe

One of the most controversial, cutting-edge ideas in cosmology—the possibility that there exist multiple parallel universes—in fact has a long history. Tom Siegfried reminds us that the size and number of the heavens have been contested since ancient times. His story offers deep lessons about the nature of science and the quest for understanding.

A pithy yet deep introduction to Einstein's general theory of relativity Of the four fundamental forces of nature, gravity might be the least understood and yet the one with which we are most intimate. On Gravity combines depth with accessibility to take us on a compelling tour of Einstein's general theory of relativity. A. Zee begins with the discovery of gravity waves, then explains how gravity can be understood in comparison to other classical field theories, presents the idea of curved spacetime, and explores black holes and Hawking radiation. Zee travels as far as the theory reaches, leaving us with tantalizing hints of the unknown, from the intransigence of quantum gravity to the mysteries of dark matter. Infused with Zee's signature warmth and fresh style, On Gravity opens a unique pathway to comprehending relativity, gravity, spacetime, and the workings of the universe.

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.

This collection of papers presents ideas and problems arising over the past 100 years regarding classical and quantum gravity, gauge theories of gravity, and spacetime transformations of accelerated frames. Both Einstein's theory of gravity and the Yang-Mills theory are gauge invariant. The invariance principles in physics have transcended both kinetic and dynamic properties and are at the very heart of our understanding of the physical world. In this spirit, this book attempts to survey the development of various formulations for gravitational and Yang-Mills fields and spacetime transformations of accelerated frames, and to reveal their associated problems and limitations.The aim is to present some of the leading ideas and problems discussed by physicists and mathematicians. We highlight three aspects: formulations of gravity as a Yang-Mills field, first discussed by Utiyama; problems of gravitational theory, discussed by Feynman, Dyson and others; spacetime properties and the physics of fields and particles in accelerated frames of reference.These unfulfilled aspects of Einstein and Yang-Mills' profound thoughts present a great challenge to physicists and mathematicians in the 21st century.

Space-time

The Number of the Heavens

The Deepest Insights of Einstein and Yang-Mills

Exact Space-Times in Einstein's General Relativity

From Einstein's Eclipse to Images of Black Holes

100 Years of Gravity and Accelerated Frames

A Mathematical Exposition

Many new tests of gravity and, in particular, of Einstein's general relativity theory will be carried out in the near future: The Lense–Thirring effect and the equivalence principle will be tested in space; moreover, gravitational waves will be detected, and new atomic interferometers and clocks will be built for measurements in gravitational and inertial fields. New high-precision devices have made these experiments feasible. They will contribute to a better understanding of gravitational physics. Both experimental developments and the theoretical concepts are collected in this volume. Exhaustive reviews give an overall insight into the subject of experimental gravitation.

Providing relevant solutions of the Einstein equation, this text introduces field equations of general relativity & their supporting mathematics. Emphasis is on the connection between observation & theory and the phenomena of gravitational physics.

Ron Cowen offers a sweeping account of the century of experimentation that has consistently confirmed Einstein ' s general theory of relativity. He shows how we got from Eddington ' s pivotal observations of the 1919 eclipse to the Event Horizon Telescope, aimed at starlight wrapping around the black hole at our galaxy ' s center.

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

Einstein's General Theory of Relativity

Gravitational Curvature

Gyros, Clocks, Interferometers...: Testing Relativistic Gravity in Space

Einstein Gravity in a Nutshell

An Introduction to Einstein's Theory of Gravity

Gravity ' s Century

This book provides an introduction to the theory of relativity and the mathematics used in its processes. Three elements of the book make it stand apart from previously published books on the theory of relativity. First, the book starts at a lower mathematical level than standard books with tensor calculus of sufficient maturity to make it possible to give detailed calculations of relativistic predictions of practical experiments. Self-contained introductions are given, for example vector calculus, differential calculus and integrations. Second, in-between calculations have been included, making it possible for the non-technical reader to follow step-by-step calculations. Thirdly, the conceptual development is gradual and rigorous in order to provide the inexperienced reader with a philosophically satisfying understanding of the theory. The goal of this book is to provide the reader with a sound conceptual understanding of both the special and general theories of relativity, and gain an insight into how the mathematics of the theory can be utilized to calculate relativistic effects.

For readers of Sean Carroll, Brian Greene, Katie Mack, and anyone who wants to know what theoretical physicists actually do. This Way to the Universe is a celebration of the astounding, ongoing scientific investigations that have revealed the nature of reality at its smallest, at its largest, and at the scale of our daily lives. The enigmas that Professor Michael Dine discusses are like landmarks on a fantastic journey to the edge of the universe. Asked where to find out about the Big Bang, Dark Matter, the Higgs boson particle—the long cutting edge of physics right now—Dine had no single book he could recommend. This is his accessible, authoritative, and up-to-date answer. Comprehensible to anyone with a high-school level education, with almost no equations, there is no better author to take you on this amazing odyssey. Dine is widely recognized as having made profound contributions to our understanding of matter, time, the Big Bang, and even what might have come before it. This Way to the Universe touches on many emotional, critical points in his extraordinary carreer while presenting mind-bending physics like his answer to the Dark Matter and Dark Energy mysteries as well as the ideas that explain why our universe consists of something rather than nothing. People assume String Theory can never be tested, but Dine intrepidly explores exactly how the theory might be tested experimentally, as well as the pitfalls of falling in love with math. This book reflects a lifetime pursuing the deepest mysteries of reality, by one of the most humble and warmly engaging voices you will ever read.

An authoritative interdisciplinary account of the historic discovery of gravitational waves In 1915, Albert Einstein predicted the existence of gravitational waves—ripples in the fabric of spacetime caused by the movement of large masses—as part of the theory of general relativity. A century later, researchers with the Laser Interferometer Gravitational-Wave Observatory (LIGO) confirmed Einstein's prediction, detecting gravitational waves generated by the collision of two black holes. Shedding new light on the hundred-year history of this momentous achievement, Einstein Was Right brings together essays by two of the physicists who won the Nobel Prize for their instrumental roles in the discovery, along with contributions by leading scholars who offer unparalleled insights into one of the most significant scientific breakthroughs of our time. This illuminating book features an introduction by Tilman Sauer and invaluable firsthand perspectives on the history and significance of the LIGO consortium by physicists Barry Barish and Kip Thorne. Theoretical physicist Alessandra Buonanno discusses the new possibilities opened by gravitational wave astronomy, and sociologist of science Harry Collins and historians of science Diana Kormos Buchwald, Daniel Kennefick, and Jürgen Renn provide further insights into the history of relativity and LIGO. The book closes with a reflection by philosopher Don Howard on the significance of Einstein's theory for the philosophy of science. Edited by Jed Buchwald, Einstein Was Right is a compelling and thought-provoking account of one of the most thrilling scientific discoveries of the modern age.

Einstein's standard and battle-tested geometric theory of gravity--spacetime tells mass how to move and mass tells spacetime how to curve--is expounded in this book by Ignazio Ciufolini and John Wheeler. They give special attention to the theory's observational checks and to two of its consequences: the predicted existence of gravitomagnetism and the origin of inertia (local inertial frames) in Einstein's general relativity: inertia here arises from mass there. The authors explain the modern understanding of the link between gravitation and inertia in Einstein's theory, from the origin of inertia in some cosmological models of the universe, to the interpretation of the initial value formulation of Einstein's standard geometrodynamics; and from the devices and the methods used to determine the local inertial frames of reference, to the experiments used to detect and measure the "dragging of inertial frames of reference." In this book, Ciufolini and Wheeler emphasize present, past, and proposed tests of gravitational interaction, metric theories, and general relativity. They describe the numerous confirmations of the foundations of geometrodynamics and some proposed experiments, including space missions, to test some of its fundamental predictions--in particular gravitomagnetic field or "dragging of inertial frames" and gravitational waves.

A Brief Tour of a Weighty Subject