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KEY=RELATIVITY - BRANDT GRETCHEN

Spacetime and Geometry

[Cambridge University Press](#) **Spacetime and Geometry** is an introductory textbook on general relativity, specifically aimed at students. Using a lucid style, Carroll first covers the foundations of the theory and mathematical formalism, providing an approachable introduction to what can often be an intimidating subject. Three major applications of general relativity are then discussed: black holes, perturbation theory and gravitational waves, and cosmology. Students will learn the origin of how spacetime curves (the Einstein equation) and how matter moves through it (the geodesic equation). They will learn what black holes really are, how gravitational waves are generated and detected, and the modern view of the expansion of the universe. A brief introduction to quantum field theory in curved spacetime is also included. A student familiar with this book will be ready to tackle research-level problems in gravitational physics.

Problem Book in Relativity and Gravitation

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

Relativity, Gravitation and Cosmology

A Basic Introduction

[Oxford University Press](#) 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.

A Relativist's Toolkit

The Mathematics of Black-Hole Mechanics

[Cambridge University Press](#) This 2004 textbook fills a gap in the literature on general relativity by providing the advanced student with practical tools for the computation of many physically interesting quantities. The context is provided by the mathematical theory of black holes, one of the most elegant, successful, and relevant applications of general relativity. Among the topics discussed are congruencies of timelike and null geodesics, the embedding of spacelike, timelike and null hypersurfaces in spacetime, and the Lagrangian and Hamiltonian formulations of general relativity. Although the book is self-contained, it is not meant to serve as an introduction to general relativity. Instead, it is meant to help the reader acquire advanced skills and become a competent researcher in relativity and gravitational physics. The primary readership consists of graduate students in gravitational physics. It will also be a useful reference for more seasoned researchers working in this field.

A General Relativity Workbook

Exact Space-Times in Einstein's General Relativity

[Cambridge University Press](#) 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.

General Relativity

[University of Chicago 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*

Special Relativity

An Introduction with 200 Problems and Solutions

[Springer Science & Business Media](#) 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, 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.

From Eternity to Here

The Quest for the Ultimate Theory of Time

[Penguin](#) "An accessible and engaging exploration of the mysteries of time." -Brian Greene, author of *The Elegant Universe* Twenty years ago, Stephen Hawking tried to explain time by understanding the Big Bang. Now, Sean Carroll says we need to be more ambitious. One of the leading theoretical physicists of his generation, Carroll delivers a dazzling and paradigm-shifting theory of time's arrow that embraces subjects from entropy to quantum mechanics to time travel to information theory and the meaning of life. From Eternity to Here is no less than the next step toward understanding how we came to exist, and a fantastically approachable read that will appeal to a broad audience of armchair physicists, and anyone who ponders the nature of our world.

Gravity

An Introduction to Einstein's General Relativity

[Cambridge University Press](#) Best-selling, accessible physics-first introduction to GR uses minimal new mathematics and begins with the essential physical applications.

A Student's Guide to General Relativity

[Cambridge University Press](#) Vectors, tensors and functions -- Manifolds, vectors and differentiation -- Energy, momentum and Einstein's equations

A First Course in 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.

Spacetime and Geometry

An Introduction to General Relativity

[Cambridge University Press](#) *Spacetime and Geometry* is an introductory textbook on general relativity, specifically aimed at students. Using a lucid style, Carroll first covers the foundations of the theory and mathematical formalism, providing an approachable introduction to what can often be an intimidating subject. Three major applications of general relativity are then discussed: black holes, perturbation theory and gravitational waves, and cosmology. Students will learn the origin of how spacetime curves (the Einstein equation) and how matter moves through it (the geodesic equation). They will learn what black holes really are, how gravitational waves are generated and detected, and the modern view of the expansion of the universe. A brief introduction to quantum field theory in curved spacetime is also included. A student familiar with this book will be ready to tackle research-level problems in gravitational physics.

Einstein Gravity in a Nutshell

[Princeton University Press](#) 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)

Spacetime Physics

[Macmillan](#) Collaboration on the First Edition of Spacetime Physics began in the mid-1960s when Edwin Taylor took a junior faculty sabbatical at Princeton University where John Wheeler was a professor. The resulting text emphasized the unity of spacetime and those quantities (such as proper time, proper distance, mass) that are invariant, the same for all observers, rather than those quantities (such as space and time separations) that are relative, different for different observers. The book has become a standard introduction to relativity. The Second Edition of Spacetime Physics embodies what the authors have learned during an additional quarter century of teaching and research. They have updated the text to reflect the immense strides in physics during the same period and modernized and increased the number of exercises, for which the First Edition was famous. Enrichment boxes provide expanded coverage of intriguing topics. An enlarged final chapter on general relativity includes new material on gravity waves, black holes, and cosmology. The Second Edition of Spacetime Physics provides a new generation of readers with a deep and simple overview of the principles of relativity.

The Perfect Theory

A Century of Geniuses and the Battle over General Relativity

[HMH](#) “One of the best popular accounts of how Einstein and his followers have been trying to explain the universe for decades” (Kirkus Reviews, starred review). Physicists have been exploring, debating, and questioning the general theory of relativity ever since Albert Einstein first presented it in 1915. This has driven their work to unveil the universe’s surprising secrets even further, and many believe more wonders remain hidden within the theory’s tangle of equations, waiting to be exposed. In this sweeping narrative of science and culture, an astrophysicist brings general relativity to life through the story of the brilliant physicists, mathematicians, and astronomers who have taken up its challenge. For these scientists, the theory has been both a treasure trove and an enigma. Einstein’s theory, which explains the relationships among gravity, space, and time, is possibly the most perfect intellectual achievement of modern physics—yet studying it has always been a controversial endeavor. Relativists were the target of persecution in Hitler’s Germany, hounded in Stalin’s Russia, and disdained in 1950s America. Even today, PhD students are warned that specializing in general relativity will make them unemployable. Still, general relativity has flourished, delivering key insights into our understanding of the origin of time and the evolution of all the stars and galaxies in the cosmos. Its adherents have revealed what lies at the farthest reaches of the universe, shed light on the smallest scales of existence, and explained how the fabric of reality emerges. Dark matter, dark energy, black holes, and string theory are all progeny of Einstein’s theory. In the midst of a momentous transformation in modern physics, as scientists look farther and more clearly into space than ever before, The Perfect Theory exposes the greater relevance of general relativity, showing us where it started, where it has led—and where it can still take us.

Gravitation

[Princeton University Press](#) 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

Modern Classical Physics

Optics, Fluids, Plasmas, Elasticity, Relativity, and Statistical Physics

[Princeton University Press](#) A groundbreaking text and reference book on twenty-first-century classical physics and its applications This first-year graduate-level text and reference book covers the fundamental concepts and twenty-first-century applications of six major areas of classical physics that every masters- or PhD-level physicist should be exposed to, but often isn't: statistical physics, optics (waves of all sorts), elastodynamics, fluid mechanics, plasma physics, and special and general relativity and cosmology. Growing out of a full-year course that the eminent researchers Kip Thorne and Roger Blandford taught at Caltech for almost three decades, this book is designed to broaden the training of physicists. Its six main topical sections are also designed so they can be used in separate courses, and the book provides an invaluable reference for researchers. Presents all the major fields of classical physics except three prerequisites: classical mechanics, electromagnetism, and elementary thermodynamics Elucidates the interconnections between diverse fields and explains their shared concepts and tools Focuses on fundamental concepts and modern, real-world applications Takes applications from fundamental, experimental, and applied physics; astrophysics and cosmology; geophysics, oceanography, and meteorology; biophysics and chemical physics; engineering and optical science and technology; and information science and technology Emphasizes the quantum roots of classical physics and how to use quantum techniques to elucidate classical concepts or simplify classical calculations Features hundreds of color figures, some five hundred exercises, extensive cross-references, and a detailed index An online illustration package is available

Time Travel in Einstein's Universe

The Physical Possibilities of Travel Through Time

[HMH](#) A Princeton astrophysicist explores whether journeying to the past or future is scientifically possible in this “intriguing” volume (Neil deGrasse Tyson). It was H. G. Wells who coined the term “time machine”—but the concept of time travel, both forward and backward, has always provoked fascination and yearning. It has mostly been dismissed as an impossibility in the world of physics; yet theories posited by Einstein, and advanced by scientists including Stephen Hawking and Kip Thorne, suggest that the phenomenon could actually occur. Building on these ideas, J. Richard Gott, a professor who has written on the subject for Scientific American, Time, and other publications, describes how travel to the future is not only possible but has already happened—and contemplates whether travel to the past is also conceivable. This look at the surprising facts behind the science fiction of time travel “deserves the attention of anyone wanting wider intellectual horizons” (Booklist). “Impressively clear language. Practical tips for chrononauts on their options for travel and the contingencies to prepare for make everything sound bizarrely plausible. Gott clearly enjoys his subject and his excitement and humor are contagious; this book is a delight to read.” —Publishers Weekly

Introduction To General Relativity And Cosmology

[World Scientific Publishing Company](#) Introduction to General Relativity and Cosmology gives undergraduate students an overview of the fundamental ideas behind the geometric theory of gravitation and spacetime. Through pointers on how to modify and generalise Einstein's theory to enhance understanding, it provides a link between standard textbook content and current research in the field. Chapters present complicated material practically and concisely, initially dealing with the mathematical foundations of the theory of relativity, in particular differential geometry. This is followed by a discussion of the Einstein field equations and their various properties. Also given is analysis of the important Schwarzschild solutions, followed by application of general relativity to cosmology. Questions with fully worked answers are provided at the end of each chapter to aid comprehension and guide learning. This pared down textbook is specifically designed for new students looking for a workable, simple presentation of some of the key theories in

modern physics and mathematics.

General Relativity and Gravitation

A Centennial Perspective

[Cambridge University Press](#) Explore spectacular advances in contemporary physics with this unique celebration of the centennial of Einstein's discovery of general relativity.

Gravitation

Foundations and Frontiers

[Cambridge University Press](#) Covering all aspects of gravitation in a contemporary style, this advanced textbook is ideal for graduate students and researchers in all areas of theoretical physics. The 'Foundation' section develops the formalism in six chapters, and uses it in the next four chapters to discuss four key applications - spherical spacetimes, black holes, gravitational waves and cosmology. The six chapters in the 'Frontier' section describe cosmological perturbation theory, quantum fields in curved spacetime, and the Hamiltonian structure of general relativity, among several other advanced topics, some of which are covered in-depth for the first time in a textbook. The modular structure of the book allows different sections to be combined to suit a variety of courses. Over 200 exercises are included to test and develop the reader's understanding. There are also over 30 projects, which help readers make the transition from the book to their own original research.

The Large Scale Structure of Space-Time

[Cambridge University Press](#) Einstein's General Theory of Relativity leads to two remarkable predictions: first, that the ultimate destiny of many massive stars is to undergo gravitational collapse and to disappear from view, leaving behind a 'black hole' in space; and secondly, that there will exist singularities in space-time itself. These singularities are places where space-time begins or ends, and the presently known laws of physics break down. They will occur inside black holes, and in the past are what might be construed as the beginning of the universe. To show how these predictions arise, the authors discuss the General Theory of Relativity in the large. Starting with a precise formulation of the theory and an account of the necessary background of differential geometry, the significance of space-time curvature is discussed and the global properties of a number of exact solutions of Einstein's field equations are examined. The theory of the causal structure of a general space-time is developed, and is used to study black holes and to prove a number of theorems establishing the inevitability of singularities under certain conditions. A discussion of the Cauchy problem for General Relativity is also included in this 1973 book.

The Road to Reality

A Complete Guide to the Laws of the Universe

[Vintage](#) ****WINNER OF THE 2020 NOBEL PRIZE IN PHYSICS**** The Road to Reality is the most important and ambitious work of science for a generation. It provides nothing less than a comprehensive account of the physical universe and the essentials of its underlying mathematical theory. It assumes no particular specialist knowledge on the part of the reader, so that, for example, the early chapters give us the vital mathematical background to the physical theories explored later in the book. Roger Penrose's purpose is to describe as clearly as possible our present understanding of the universe and to convey a feeling for its deep beauty and philosophical implications, as well as its intricate logical interconnections. The Road to Reality is rarely less than challenging, but the book is leavened by vivid descriptive passages, as well as hundreds of hand-drawn diagrams. In a single work of colossal scope one of the world's greatest scientists has given us a complete and unrivalled guide to the glories of the universe that we all inhabit. 'Roger Penrose is the most important physicist to work in relativity theory except for Einstein. He is one of the very few people I've met in my life who, without reservation, I call a genius' Lee Smolin

General Relativity

An Introduction for Physicists

Written for advanced undergraduate and graduate students, this is a clear mathematical introduction to Einstein's theory of general relativity and its physical applications. Concentrating on the theory's physical consequences, this approachable textbook contains over 300 exercises to illuminate and extend the discussion.

A Universe from Nothing

Why There Is Something Rather than Nothing

[Simon and Schuster](#) Bestselling author and acclaimed physicist Lawrence Krauss offers a paradigm-shifting view of how everything that exists came to be in the first place. "Where did the universe come from? What was there before it? What will the future bring? And finally, why is there something rather than nothing?" One of the few prominent scientists today to have crossed the chasm between science and popular culture, Krauss describes the staggeringly beautiful experimental observations and mind-bending new theories that demonstrate not only can something arise from nothing, something will always arise from nothing. With a new preface about the significance of the discovery of the Higgs particle, A Universe from Nothing uses Krauss's characteristic wry humor and wonderfully clear explanations to take us back to the beginning of the beginning, presenting the most recent evidence for how our universe evolved—and the implications for how it's going to end. Provocative, challenging, and delightfully readable, this is a game-changing look at the most basic underpinning of existence and a powerful antidote to outmoded philosophical, religious, and scientific thinking.

General Relativity

[Springer Science & Business Media](#) Based on a course taught for years at Oxford, this book offers a concise exposition of the central ideas of general relativity. The focus is on the chain of reasoning that leads to the relativistic theory from the analysis of distance and time measurements in the presence of gravity, rather than on the underlying mathematical structure. Includes links to recent developments, including theoretical work and observational evidence, to encourage further study.

Relativity Made Relatively Easy

[Oxford University Press](#) 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 be regarded as hard; to make derivations as simple as possible and physical ideas as transparent as possible.

Gravity and Strings

[Cambridge University Press](#) Self-contained and comprehensive, this definitive new edition provides a complete overview of the intersection of gravity, supergravity, and superstrings.

Modern General Relativity

Black Holes, Gravitational Waves, and Cosmology

[Cambridge University Press](#) Einstein's general theory of relativity is widely considered to be one of the most elegant and successful scientific theories ever developed, and it is increasingly being taught in a simplified form at advanced undergraduate level within both physics and mathematics departments. Due to the increasing interest in gravitational physics, in both the academic and the public sphere, driven largely by widely-publicised developments such as the recent observations of gravitational waves, general relativity is also one of the most popular scientific topics pursued through self-study. Modern General Relativity introduces the reader to the general theory of relativity using an example-based approach, before describing some of its most important applications in cosmology and astrophysics, such as gamma-ray bursts, neutron stars, black holes, and gravitational waves. With hundreds of worked examples, explanatory boxes, and end-of-chapter problems, this textbook provides a solid foundation for understanding one of the towering achievements of twentieth-century physics.

Gravity from the Ground Up

An Introductory Guide to Gravity and General Relativity

[Cambridge University Press](#) This book invites the reader to understand our Universe, not just marvel at it. From the clock-like motions of the planets to the catastrophic collapse of a star into a black hole, gravity controls the Universe. Gravity is central to modern physics, helping to answer the deepest questions about the nature of time, the origin of the Universe and the unification of the forces of nature. Linking key experiments and observations through careful physical reasoning, the author builds the reader's insight step-by-step from simple but profound facts about gravity on Earth to the frontiers of research. Topics covered include the nature of stars and galaxies, the mysteries of dark matter and dark energy, black holes, gravitational waves, inflation and the Big Bang. Suitable for general readers and for undergraduate courses, the treatment uses only high-school level mathematics, supplemented by optional computer programs, to explain the laws of physics governing gravity.

The Big Picture

On the Origins of Life, Meaning, and the Universe Itself

[Penguin](#) The instant New York Times bestseller about humanity's place in the universe—and how we understand it. “Vivid...impressive....Splendidly informative.”—The New York Times “Succeeds spectacularly.”—Science “A tour de force.”—Salon Already internationally acclaimed for his elegant, lucid writing on the most challenging notions in modern physics, Sean Carroll is emerging as one of the greatest humanist thinkers of his generation as he brings his extraordinary intellect to bear not only on Higgs bosons and extra dimensions but now also on our deepest personal questions: Where are we? Who are we? Are our emotions, our beliefs, and our hopes and dreams ultimately meaningless out there in the void? Do human purpose and meaning fit into a scientific worldview? In short chapters filled with intriguing historical anecdotes, personal asides, and rigorous exposition, readers learn the difference between how the world works at the quantum level, the cosmic level, and the human level—and then how each connects to the other. Carroll's presentation of the principles that have guided the scientific revolution from Darwin and Einstein to the origins of life, consciousness, and the universe is dazzlingly unique. Carroll shows how an avalanche of discoveries in the past few hundred years has changed our world and what really matters to us. Our lives are dwarfed like never before by the immensity of space and time, but they are redeemed by our capacity to comprehend it and give it meaning. The Big Picture is an unprecedented scientific worldview, a tour de force that will sit on shelves alongside the works of Stephen Hawking, Carl Sagan, Daniel Dennett, and E. O. Wilson for years to come.

Something Deeply Hidden

Quantum Worlds and the Emergence of Spacetime

[Penguin](#) INSTANT NEW YORK TIMES BESTSELLER A Science News favorite science book of 2019 As you read these words, copies of you are being created. Sean Carroll, theoretical physicist and one of this world's most celebrated writers on science, rewrites the history of 20th century physics. Already hailed as a masterpiece, Something Deeply Hidden shows for the first time that facing up to the essential puzzle of quantum mechanics utterly transforms how we think about space and time. His reconciling of quantum mechanics with Einstein's theory of relativity changes, well, everything. Most physicists haven't even recognized the uncomfortable truth: physics has been in crisis since 1927. Quantum mechanics has always had obvious gaps—which have come to be simply ignored. Science popularizers keep telling us how weird it is, how impossible it is to understand. Academics discourage students from working on the "dead end" of quantum foundations. Putting his professional reputation on the line with this audacious yet entirely reasonable book, Carroll says that the crisis can now come to an end. We just have to accept that there is more than one of us in the universe. There are many, many Sean Carrolls. Many of every one of us. Copies of you are generated thousands of times per second. The Many Worlds

Theory of quantum behavior says that every time there is a quantum event, a world splits off with everything in it the same, except in that other world the quantum event didn't happen. Step-by-step in Carroll's uniquely lucid way, he tackles the major objections to this otherworldly revelation until his case is inescapably established. Rarely does a book so fully reorganize how we think about our place in the universe. We are on the threshold of a new understanding—of where we are in the cosmos, and what we are made of.

Introducing Einstein's Relativity

The Formation of Black Holes in General Relativity

[European Mathematical Society](#) In 1965 Penrose introduced the fundamental concept of a trapped surface, on the basis of which he proved a theorem which asserts that a spacetime containing such a surface must come to an end. The presence of a trapped surface implies, moreover, that there is a region of spacetime, the black hole, which is inaccessible to observation from infinity. Since that time a major challenge has been to find out how trapped surfaces actually form, by analyzing the dynamics of gravitational collapse. The present monograph achieves this aim by establishing the formation of trapped surfaces in pure general relativity through the focusing of gravitational waves. The theorems proved in this monograph constitute the first foray into the long-time dynamics of general relativity in the large, that is, when the initial data are no longer confined to a suitable neighborhood of trivial data. The main new method, the short pulse method, applies to general systems of Euler-Lagrange equations of hyperbolic type and provides the means to tackle problems which have hitherto seemed unapproachable. This monograph will be of interest to people working in general relativity, geometric analysis, and partial differential equations.

300 Problems in Special and General Relativity

With Complete Solutions

[Cambridge University Press](#) Einstein's theories of special relativity and general relativity form a core part of today's undergraduate (or Masters-level) physics curriculum. This is a supplementary problem book or student's manual, consisting of 150 problems in each of special and general relativity. The problems, which have been developed, tested and refined by the authors over the past two decades, are a mixture of short-form and multi-part extended problems, with hints provided where appropriate. Complete solutions are elaborated for every problem, in a different section of the book; some solutions include brief discussions on their physical or historical significance. Designed as a companion text to complement a main relativity textbook, it does not assume access to any specific textbook. This is a helpful resource for advanced students, for self-study, a source of problems for university teaching assistants, or as inspiration for instructors and examiners constructing problems for their lectures, homework or exams.

Spacetime, Geometry, Cosmology

[Courier Dover Publications](#) Novel interpretation of the relationship between space, time, gravitation, and their cosmological implications; based on author's discovery of a value in gravitation overlooked by both Newton and Einstein. 1982 edition.

The Particle at the End of the Universe

How the Hunt for the Higgs Boson Leads Us to the Edge of a New World

[Penguin](#) Winner of the prestigious 2013 Royal Society Winton Prize for Science Books "A modern voyage of discovery." —Frank Wilczek, Nobel Laureate, author of *The Lightness of Being* The Higgs boson is one of our era's most fascinating scientific frontiers and the key to understanding why mass exists. The most recent book on the subject, *The God Particle*, was a bestseller. Now, Caltech physicist Sean Carroll documents the doorway that is opening—after billions of dollars and the efforts of thousands of researchers at the Large Hadron Collider in Switzerland—into the mind-boggling world of dark matter. *The Particle at the End of the Universe* has it all: money and politics, jealousy and self-sacrifice, history and cutting-edge physics—all grippingly told by a rising star of science writing.