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# Gravitation Charles W Misner

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Einstein's Enigma or Black Holes in My Bubble Bath

Cosmology

A First Course in General Relativity

Modern Classical Physics

Mach's Principle and the Origin of Inertia

Black Holes and Time Warps

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### **Einstein's Enigma or Black Holes in My Bubble Bath**

Cambridge University Press

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.

Cosmology Macmillan

We are all agreed that your theory is crazy. The question which

divides us is whether it is crazy enough. Niels Bohr Superstring theory has emerged as the most promising candidate for a quantum theory of all known interactions. Superstrings apparently solve a problem that has defied solution for the past 50 years, namely the unification of the two great fundamental physical theories of the century, quantum field theory and general relativity. Superstring theory introduces an entirely new physical picture into theoretical physics and a new mathematics that has startled even the mathematicians. Ironically, although superstring theory is supposed to provide a unified field theory of the universe, the theory itself often seems like a confused jumble of folklore, random rules of thumb, and intuition. This is because the development of superstring theory has been unlike that of any other theory, such as general relativity, which began with a geometry and an action and later evolved into a quantum theory. Superstring theory, by contrast, has been evolving backward for the past 20 years. It has a bizarre history, beginning with the purely accidental discovery of the quantum theory in 1968 by G. Veneziano and M. Suzuki. Thumbing through old math books, they stumbled by chance on the Beta function, written down in the last century by mathematician Leonhard Euler.

*A First Course in General Relativity* Cambridge University Press  
Dive into a mind-bending exploration of the physics of black holes. Black holes, predicted by Albert Einstein's general theory of relativity more than a century ago, have long intrigued scientists and the public with their bizarre and fantastical properties. Although Einstein understood that black holes were mathematical solutions to his equations, he never accepted their physical reality—a viewpoint many shared. This all changed in the 1960s

and 1970s, when a deeper conceptual understanding of black holes developed just as new observations revealed the existence of quasars and X-ray binary star systems, whose mysterious properties could be explained by the presence of black holes. Black holes have since been the subject of intense research—and the physics governing how they behave and affect their surroundings is stranger and more mind-bending than any fiction. After introducing the basics of the special and general theories of relativity, this book describes black holes both as astrophysical objects and theoretical “laboratories” in which physicists can test their understanding of gravitational, quantum, and thermal physics. From Schwarzschild black holes to rotating and colliding black holes, and from gravitational radiation to Hawking radiation and information loss, Steven Gubser and Frans Pretorius use creative thought experiments and analogies to explain their subject accessibly. They also describe the decades-long quest to observe the universe in gravitational waves, which recently resulted in the LIGO observatories' detection of the distinctive gravitational wave “chirp” of two colliding black holes—the first direct observation of black holes' existence. *The Little Book of Black Holes* takes readers deep into the mysterious heart of the subject, offering rare clarity of insight into the physics that makes black holes simple yet destructive manifestations of geometric destiny.

**Modern Classical Physics** Oxford University Press

Jo Dunkley combines her expertise as an astrophysicist with her talents as a writer and teacher to present an elegant introduction to the structure, history, and enduring mysteries of the universe. Among the cutting-edge phenomena discussed are the

accelerating expansion of the universe and the possibility that our universe is only one of many.

**Mach's Principle and the Origin of Inertia** 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

**Black Holes and Time Warps** Springer Science & Business Media

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.

Princeton University Press

The Feynman Lectures on Gravitation are based on notes prepared during a course on gravitational physics that Richard Feynman taught at Caltech during the 1962-63 academic year. For several years prior to these lectures, Feynman thought long and hard about the fundamental problems in gravitational physics, yet he published very little. These lectures represent a useful record of his viewpoints and some of his insights into gravity and its application to cosmology, superstars, wormholes, and gravitational waves at that particular time. The lectures also contain a number of fascinating digressions and asides on the foundations of physics and other issues. Characteristically, Feynman took an untraditional non-geometric approach to gravitation and general relativity based on the underlying quantum aspects of gravity. Hence, these lectures contain a unique pedagogical account of the development of Einstein's general theory of relativity as the inevitable result of the demand for a self-consistent theory of a massless spin-2 field (the graviton) coupled to the energy-momentum tensor of matter. This approach also demonstrates the intimate and fundamental connection between gauge invariance and the principle of equivalence.

**Einstein Gravity in a Nutshell** 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.

*An Introductory Guide to Gravity and General Relativity* Oxford University Press

An inviting, intuitive, and visual exploration of differential geometry and forms *Visual Differential Geometry and Forms* fulfills two principal goals. In the first four acts, Tristan Needham puts the geometry back into differential geometry. Using 235 hand-drawn diagrams, Needham deploys Newton's geometrical methods to provide geometrical explanations of the classical results. In the fifth act, he offers the first undergraduate introduction to differential forms that treats advanced topics in an intuitive and geometrical manner. Unique features of the first four acts include: four distinct geometrical proofs of the fundamentally important Gauss-Bonnet theorem, providing a stunning link between local geometry and global topology; a simple, geometrical proof of Gauss's famous Theorema Egregium; a complete geometrical treatment of the Riemann curvature tensor of an  $n$ -manifold; and a detailed geometrical treatment of Einstein's field equation, describing

gravity as curved spacetime (General Relativity), together with its implications for gravitational waves, black holes, and cosmology. The final act elucidates such topics as the unification of all the integral theorems of vector calculus; the elegant reformulation of Maxwell's equations of electromagnetism in terms of 2-forms; de Rham cohomology; differential geometry via Cartan's method of moving frames; and the calculation of the Riemann tensor using curvature 2-forms. Six of the seven chapters of Act V can be read completely independently from the rest of the book. Requiring only basic calculus and geometry, *Visual Differential Geometry and Forms* provocatively rethinks the way this important area of mathematics should be considered and taught.

**Gravitation** Springer Science & Business Media

The autobiography of one of the preeminent figures in twentieth-century physics. He studied with Niels Bohr, taught Richard Feynman, and boned up on relativity with his friend and colleague Albert Einstein. John Archibald Wheeler's fascinating life brings us face to face with the central characters and discoveries of modern physics. He was the first American to learn of the discovery of nuclear fission, later coined the term "black hole," led a renaissance in gravitation physics, and helped to build Princeton University into a mecca for physicists. From nuclear physics, to quantum theory, to relativity and gravitation, Wheeler's work has set the trajectory of research for half a century. His career has brought him into contact with the most brilliant minds of his field; Fermi, Bethe, Rabi, Teller, Oppenheimer, and Wigner are among those he called colleagues and friends. In this rich autobiography, Wheeler reveals in fascinating detail the excitement of each discovery, the character

of each colleague, and the underlying passion for knowledge that drives him still.

Einstein's Outrageous Legacy Princeton University Press

Publisher description

**Solving Einstein's Equations on the Computer** Gravitation

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.

Gravity from the Ground Up Cambridge University Press

What is a black hole? How many of them are in our Universe? Can black holes be created in a laboratory or in particle colliders? Can objects similar to black holes be used for space and time travel? This book discusses these and many other questions providing the reader with the tools required to explore the Black Hole Land independently.

**Introduction to Superstrings** W. W. Norton & Company

Geometrodynamics, general relativity, the mathematics of curved spacetime, Einstein's theories, relativistic stars, and gravitational collapse are some of the topics examined in a study of gravitational physics

**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.

*Classical and Quantum Cosmology* Cambridge University Press

This comprehensive textbook is devoted to classical and quantum cosmology, with particular emphasis on modern approaches to quantum gravity and string theory and on their observational imprint. It covers major challenges in theoretical physics such as the big bang and the cosmological constant problem. An extensive review of standard cosmology, the cosmic microwave background, inflation and dark energy sets the scene for the phenomenological application of all the main quantum-gravity and string-theory models of cosmology. Born of the author's teaching experience and commitment to bridging the gap between cosmologists and theoreticians working beyond the established laws of particle physics and general relativity, this is a unique text where quantum-gravity approaches and string theory are treated on an equal footing. As well as introducing cosmology to undergraduate and graduate students with its pedagogical presentation and the help of 45 solved exercises, this book, which includes an ambitious bibliography of about 3500 items, will serve as a valuable reference for lecturers and

researchers.

*Relativity, Gravitation and Cosmology* CRC Press

Einstein's theory of general relativity is a cornerstone of modern physics. It also touches upon a wealth of topics that students find fascinating – black holes, warped spacetime, gravitational waves, and cosmology. Now reissued by Cambridge University Press, this 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.

[A Basic Introduction](#) Oxford University Press on Demand

BL Fully up-to-date reference on a `hot' topic of research BL The only book available covering knot theory and quantum theory Recent work by mathematicians and physicists has uncovered surprising connections between knot theory and the problem of developing a quantum theory of gravity. This volume is a proceedings of a workshop on the subject held in 1993 at the University of California at Riverside attended by many experts in this exciting area of research.

Related with Gravitation Charles W Misner:

### **Introduction To General Relativity And Cosmology**

Cambridge University Press

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.

[Notes Towards a Very Gentle Introduction to the Mathematics of Relativity](#) Springer

A substantial update of this award-winning and highly regarded cosmology textbook, for advanced undergraduates in physics and astronomy.

- Periodic Table Scavenger Hunt Worksheet : [click here](#)