# Relativity Gravitation And Cosmology A Basic Introduction Oxford Master Series In Physics

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Problem Book in Relativity and Gravitation Alan P. Lightman 2017-09-01 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 modem textbooks in general relativity.

**Relativity, Gravitation and Cosmology** Ta-Pei Cheng 2005 An introduction to Einstein's general theory of relativity, this work is structured so that interesting applications, such as gravitational lensing, black holes and cosmology, can be presented without the readers having to first learn the difficult mathematics of tensor calculus.

**Introduction To General Relativity And Cosmology** Christian G Boehmer 2016-10-06 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.

*Fundamentals of Cosmology* James Rich 2013-04-17 A self-contained introduction to general relativity that is based on the homogeneity and isotropy of the local universe. Emphasis is placed on estimations of the densities of matter and vacuum energy, and on investigations of the primordial density fluctuations and the nature of dark matter.

**General Relativity** Robert M. Wald 2010-05-15 "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

**Relativity, Gravitation, and Cosmology** Ta-Pei Cheng 2005 An introduction to Einstein's general theory of relativity, this work is structured so that interesting applications, such as gravitational lensing, black holes and cosmology, can be presented without the readers having to first learn the difficult mathematics of tensor calculus.

*Gravity* James B. Hartle 2021-06-24 Best-selling, accessible physics-first introduction to GR uses minimal new mathematics and begins with the essential physical applications.

**Introduction to 3+1 Numerical Relativity** Miguel Alcubierre 2008-04-10 This book introduces the modern field of 3+1 numerical relativity. The book has been written in a way as to be as self-contained as possible, and only assumes a basic knowledge of special relativity. Starting from a brief introduction to general relativity, it discusses the different concepts and tools necessary for the fully consistent numerical simulation of relativistic astrophysical systems, with strong and dynamical gravitational fields. Among the topics discussed in detail are the following: the initial data problem, hyperbolic reductions of the field equations, gauge conditions, the evolution of black hole space-times, relativistic hydrodynamics, gravitational wave extraction and numerical methods. There is also a final chapter with examples of some simple numerical space-times. The book is aimed at both graduate students and researchers in physics and astrophysics, and at those interested in relativistic astrophysics.

**Principles of Cosmology and Gravitation** Michael V Berry 2017-10-19 General relativity and quantum mechanics have become the two central pillars of theoretical physics. Moreover, general relativity has important applications in astrophysics and high-energy particle physics. Covering the fundamentals of the subject, Principles of Cosmology and Gravitation describes the universe as revealed by observations and presents a theoretical framework to enable important cosmological formulae to be derived and numerical calculations performed. Avoiding elaborate formal discussions, the book presents a practical approach that focuses on the general theory of relativity. It examines different evolutionary models and the gravitational effects of massive bodies. The book also includes a large number of worked examples and problems, half with solutions.

An Introduction to Mathematical Cosmology J. N. Islam 2002 An introductory textbook on mathematical cosmology for beginning graduate students.

*Tensors, Relativity, and Cosmology* Mirjana Dalarsson 2015-07-08 Tensors, Relativity, and Cosmology, Second Edition, combines relativity, astrophysics, and cosmology in a single volume, providing a simplified introduction to each subject that is followed by detailed mathematical derivations. The book includes a section on general relativity that gives the case for a curved space-time, presents the mathematical background (tensor calculus, Riemannian geometry), discusses the Einstein equation and its solutions (including black holes and Penrose processes), and considers the energy-momentum tensor for various solutions. In addition, a section on relativistic astrophysics discusses stellar contraction and collapse, neutron stars and their equations of state, black holes, and accretion onto collapsed objects, with a final section on cosmology discussing cosmological models, observational tests, and scenarios for the early universe. This fully revised and updated second edition includes new material on relativistic effects, such as the behavior of clocks and measuring rods in motion, relativistic addition of velocities, and the twin paradox, as well as new material on gravitational waves, amongst other topics. Clearly combines relativity, astrophysics, and cosmology in a single volume Extensive introductions to each section are followed by relevant examples and numerous exercises Presents topics of interest to those researching and studying tensor calculus, the theory of relativity, gravitation, cosmology, quantum

cosmology, Robertson-Walker Metrics, curvature tensors, kinematics, black holes, and more Fully revised and updated with 80 pages of new material on relativistic effects, such as relativity of simultaneity and relativity of the concept of distance, amongst other topics Provides an easy-to-understand approach to this advanced field of mathematics and modern physics by providing highly detailed derivations of all equations and results

**General Relativity** Hans Stephani 1990-06-29 This is an excellent introduction to the subjects of gravitation and space-time structure. It discusses the foundations of Riemann geometry; the derivation of Einstein field equations; linearised theory; far fields and gravitational waves; the invariant characterisation of exact solutions; gravitational collapse; cosmology as well as alternative gravitational theories and the problem of quantum gravity.

*Gravitation, Cosmology, and Cosmic-Ray Physics* National Research Council 1986-02-01

**Modern General Relativity** Mike Guidry 2019-01-03 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.

**Special Relativity** Michael Tsamparlis 2010-05-17 Writing a new book on the classic subject of Special Relativity, on which numerous important physicists have contributed and many books have already been written, can be like adding another epicycle to the Ptolemaic cosmology. Furthermore, it is our belief that if a book has no new elements, but simply repeats what is written in the existing literature, perhaps with a different style, then this is not enough to justify its publication. However, after having spent a number of years, both in class and research with relativity, I have come to the conclusion that there exists a place for a new book. Since it appears that somewhere along the way, mathem- ics may have obscured and prevailed to the degree that we tend to teach relativity (and I believe, theoretical physics) simply using “heavier” mathematics without the inspiration and the mastery of the classic physicists of the last century. Moreover current trends encourage the application of techniques in producing quick results and not tedious conceptual approaches resulting in long-lasting reasoning. On the other hand, physics cannot be done a´ la carte stripped from philosophy, or, to put it in a simple but dramatic context A building is not an accumulation of stones! As a result of the above, a major aim in the writing of this book has been the distinction between the mathematics of Minkowski space and the physics of r- ativity.

**An Introduction to General Relativity and Cosmology** Jerzy Plebanski 2006-08-14 General relativity is a cornerstone of modern physics, and is of major importance in its applications to cosmology. Plebanski and Krasinski are experts in the field and in this book they provide a thorough introduction to general relativity, guiding the reader through complete derivations of the most important results. Providing coverage from a unique viewpoint, geometrical, physical and astrophysical properties of inhomogeneous cosmological models are all systematically and clearly presented, allowing the reader to follow and verify all derivations. For advanced undergraduates and graduates in physics and astronomy, this textbook will enable students to develop expertise in the mathematical techniques necessary to study general relativity.

**Introduction to General Relativity** Lewis Ryder 2009-06-11 Student-friendly, well illustrated textbook for advanced undergraduate and beginning graduate students in physics and mathematics.

*Physical Foundations of Cosmology* Viatcheslav Mukhanov 2005-11-10 Inflationary cosmology has been developed over the last twenty years to remedy serious shortcomings in the standard hot big bang model of the universe. This textbook, first published in 2005, explains the basis of modern cosmology and shows where the theoretical results come from. The book is divided into two parts; the first deals with the homogeneous and isotropic model of the Universe, the second part discusses how inhomogeneities can explain its structure. Established material such as the inflation and quantum cosmological perturbation are presented in great detail, however the reader is brought to the frontiers of current cosmological research by the discussion of more speculative ideas. An ideal textbook for both advanced students of physics and astrophysics, all of the necessary background material is included in every chapter and no prior knowledge of general relativity and quantum field theory is assumed.

**Gravity: A Very Short Introduction** Timothy Clifton 2017-02-10 Gravity is one of the four fundamental interactions that exist in nature. It also has the distinction of being the oldest, weakest, and most difficult force to quantize. Understanding gravity is not only essential for understanding the motion of objects on Earth, but also the motion of all celestial objects, and even the expansion of the Universe itself. It was the study of gravity that led Einstein to his profound realisations about the nature of space and time. Gravity is not only universal, it is also essential for understanding the behaviour of the Universe, and all astrophysical bodies within it. In this Very Short Introduction Timothy Clifton looks at the development of our understanding of gravity since the early observations of Kepler and Newtonian theory. He discusses Einstein's theory of gravity, which now supplants Newton's, showing how it allows us to understand why the frequency of light changes as it passes through a gravitational field, why GPS satellites need their clocks corrected as they orbit the Earth, and why the orbits of distant neutron stars speed up. Today, almost 100 years after Einstein published his theory of gravity, we have even detected the waves of gravitational radiation that he predicted. Clifton concludes by considering the testing and application of general relativity in astrophysics and cosmology, and looks at dark energy and efforts such as string theory to combine gravity with quantum mechanics. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

*Gravitation and cosmology* Steven Weinberg 2004

**Relativity, Gravitation, and Cosmology** Ta-Pei Cheng 2005 An introduction to Einstein's general theory of relativity, this work is structured so that interesting applications, such as gravitational lensing, black holes and cosmology, can be presented without the readers having to first learn the difficult mathematics of tensor calculus.

General Relativity and Cosmology Ronald J. Adler 2021-01-22 Gravitational physics has now become a mainstream topic in physics and physics teaching. In particular cosmology and gravitational wave physics are at the focus of a great deal of current research. Thus it is important to introduce students to General Relativity as soon as reasonable. This textbook offers a brief but comprehensive treatment accessible to advanced undergraduate students, graduate students, and any physicist or mathematician interested in understanding the material in a short time. The author, an experienced teacher of the subject, has included numerous examples and exercises to help students consolidate the ideas they have learned.

**Cosmology: A Very Short Introduction** Peter Coles 2001-08-23 This book is a simple, non-technical introduction to cosmology, explaining what it is and what cosmologists do. Peter Coles discusses the history of the subject, the development of the Big Bang theory, and more speculative modern issues like quantum cosmology, superstrings, and dark matter. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert

authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.
Gravitation and Spacetime Hans C. Ohanian 2013-04-08 This text provides a quantitative introduction to general relativity for advanced undergraduate and graduate students.
*Introduction to General Relativity, Black Holes, and Cosmology* Yvonne Choquet-Bruhat 2015-01-21 General Relativity is a beautiful geometric theory, simple in its mathematical formulation but leading to numerous consequences with striking physical interpretations: gravitational waves, black holes, cosmological models, and so on. This introductory textbook is written for mathematics students interested in physics and physics students interested in exact mathematical formulations (or for anyone with a scientific mind who is curious to know more of the world we live in), recent remarkable experimental and observational results which confirm the theory are clearly described and no specialised physics knowledge is required. The mathematical level of Part A is aimed at undergraduate students and could be the basis for a course on General Relativity. Part B is more advanced, but still does not require sophisticated mathematics. Based on Yvonne Choquet-Bruhat's more advanced text, General Relativity and the Einstein Equations, the aim of this book is to give with precision, but as simply as possible, the foundations and main consequences of General Relativity. The first five chapters from General Relativity and the Einstein Equations have been updated with new sections and chapters on black holes, gravitational waves, singularities, and the Reissner-Nordstrom and interior Schwarzchild solutions. The rigour behind this book will provide readers with the perfect preparation to follow the great mathematical progress in the actual development, as well as the ability to model, the latest astrophysical and cosmological observations. The book presents basic General Relativity and provides a basis for understanding and using the fundamental theory.
**Gravity from the Ground Up** Bernard Schutz 2003-12-04 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.
*Gravitation* Charles W. Misner 2017-10-24 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
*Elements of General Relativity* Piotr T. Chruściel 2020-03-19 This book provides an introduction to the mathematics and physics of general relativity, its basic physical concepts, its observational implications, and the new insights obtained into the nature of space-time and the structure of the universe. It introduces some of the most striking aspects of Einstein's theory of gravitation: black holes, gravitational waves, stellar models, and cosmology. It contains a self-contained introduction to tensor calculus and Riemannian geometry, using in parallel the language of modern differential geometry and the coordinate notation, more familiar to physicists. The author has strived to achieve mathematical rigour, with all notions given careful mathematical meaning, while trying to maintain the formalism to the minimum fit-for-purpose. Familiarity with special relativity is assumed. The overall aim is to convey some of the main physical and geometrical properties of Einstein's theory of gravitation, providing a solid entry point to further studies of the mathematics and physics of Einstein equations.
**Relativity, Gravitation, Cosmology** Valeriy V. Dvoeglazov 2018-11-16 The authors continue the book series entitled Contemporary Fundamental

Physics. Edited by Professor Doctor V. V. Dvoeglazov from Universidad de Zacatecas, Mexico, this thematic issue Relativity, Gravitation, Cosmology: Beyond Foundations contains chapters related to contemporary problems of modern physics. This book includes an Editorial Introduction and eleven chapters, commentary, and several reprints. This book may also be considered as the continuation of past publications found in the authors own series concerning relativity. This issue includes contributions from M. Land, V. V. Varlamov, E. Kapuscik, I. A. Vernigora and Yu. G. Rudoy, E. M. Ovsiyuk, V. V. Kisel and V. M. Redkov, O. V. Veko, S. I. Kruglov, B. G. Sidharth, A. Gutierrez-Rodriguez, M. A. Hernandez-Ruiz and A. Gonzalez-Sanchez, and V. V. Dvoeglazov. Older research concerns quantum field theory and gravitation theories. Recent research has been presented at the XI Workshop (2015) and the X and XI Schools (2014 and 2016) of the Gravitation Division of the Sociedad Mexicana de Fisica. The book will be useful to researchers, professors, and students of physics and mathematics.

**Introduction to Cosmology** Barbara Ryden 2016-11-17 A substantial update of this award-winning and highly regarded cosmology textbook, for advanced undergraduates in physics and astronomy.

*Relativity, Gravitation, Cosmology* V. V. Dvoeglazov 2015-12-01 The authors continue the book series 'Contemporary Fundamental Physics' through Nova Science Publishers. The editor is Professor Doctor V. V. Dvoeglazov from Universidad de Zacatecas, Mexico. The thematic issue, "Relativity, Gravitation, Cosmology: Foundations", contains articles related to contemporary problems of modern physics. The book includes an editorial introduction and 10 chapters. The old problems are considered in quantum field theory and gravitation theories. So, the authors restore time connection in physics that has been decoupled over the last twelve years. This book may be considered as a continuation of books in our Series on Relativity.

Spacetime and Geometry Sean M. Carroll 2019-07-31 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.

Gravitation and Cosmology Steven Weinberg 1972 Weinberg's 1972 work, in his description, had two purposes. The first was practical to bring together and assess the wealth of data provided over the previous decade while realizing that newer data would come in even as the book was being printed. He hoped the comprehensive picture would prepare the reader and himself to that new data as it emerged. The second was to produce a textbook about general relativity in which geometric ideas were not given a starring role for (in his words) too great an emphasis on geometry can only obscure the deep connections between gravitation and the rest of physics.

*Gravitational Curvature* Theodore Frankel 2013-04-10 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.

*Relativity, Gravitation and Cosmology* Ta-Pei Cheng 2010-01 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.

**Relativity, Gravitation and Cosmology** Robert J. Lambourne 2010-06 The textbook

introduces students to basic geometric concepts, such as metrics, connections and curvature, before examining general relativity in more detail. It shows the observational evidence supporting the theory, and the description general relativity provides of black holes and cosmological spacetimes. --

*Introducing Einstein's Relativity* Ray D'Inverno 1995

A Short Course in General Relativity James A. Foster 2010-04-30 Suitable for a one-semester course in general relativity for senior undergraduates or beginning graduate students, this text clarifies the mathematical aspects of Einstein's theory of relativity without sacrificing physical understanding.

*A First Course in General Relativity* Bernard Schutz 2009-05-14 Second edition of a widely-used textbook providing the first step into general relativity for undergraduate students with minimal mathematical background.

**A College Course on Relativity and Cosmology** Ta-Pei Cheng 2015-06-18 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.