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# General Relativity A First Course For Physicists Prentice Hall International Series In Physics And Applied Physics

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Relativity: The Special and General Theory Cambridge University Press

The foundations are thoroughly developed together with the required mathematical background from differential geometry developed in Part III. The author also discusses the tests of general relativity in detail, including binary pulsars, with much

space is devoted to the study of compact objects, especially to neutron stars and to the basic laws of black-hole physics. This well-structured text and reference enables readers to easily navigate through the various sections as best matches their backgrounds and perspectives, whether mathematical, physical or astronomical. Very applications oriented, the text includes very recent results, such as the supermassive black-hole in our galaxy and first double pulsar system

General Relativity Diamond Pocket Books Pvt Ltd

Einstein's general theory of relativity -- currently our best theory

of gravity -- is important not only to specialists, but to a much wider group of physicists. This short textbook on general relativity and gravitation offers students glimpses of the vast landscape of science connected to general relativity. It incorporates some of the latest research in the field. The book is aimed at readers with a broad range of interests in physics, from cosmology, to gravitational radiation, to high energy physics, to condensed matter theory. The pedagogical approach is "physics first": readers move very quickly to the calculation of observational predictions, and only return to the mathematical foundations after the physics is established. In addition to the "standard" topics covered by most introductory textbooks, it contains short introductions to more advanced topics: for instance, why field equations are second order, how to treat gravitational energy, and what is required for a Hamiltonian formulation of general relativity. A concluding chapter discusses directions for further study, from mathematical relativity, to experimental tests, to quantum gravity. This is an introductory text, but it has also been written as a jumping-off point for readers who plan to study more specialized topics.

*General Relativity for Mathematicians* Springer Science & Business Media

A First Course in General Relativity Cambridge University Press

**General Relativity Without Calculus** Cambridge University Press

Nobel Laureate Steven Weinberg explains the foundations of modern physics in historical context for undergraduates and beyond.

**General Relativity** Cambridge University Press

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.

#### **A Concise Introduction** □□□□□□□□□□

Aimed at advanced undergraduates with background knowledge of classical mechanics and electricity and magnetism, this textbook presents both the particle dynamics relevant to general relativity, and the field dynamics necessary to understand the theory. Focusing on action extremization, the book develops the structure and predictions of general relativity by analogy with familiar physical systems. Topics ranging from classical field theory to minimal surfaces and relativistic strings are covered in a homogeneous manner. Nearly 150 exercises and numerous examples throughout the textbook enable students to test their understanding of the material covered. A tensor manipulation package to help students overcome the computational challenge associated with general relativity is available on a site hosted by the author. A link to this and to a solutions manual can be found at [www.cambridge.org/9780521762458](http://www.cambridge.org/9780521762458).

General Relativity Springer

Vectors, tensors and functions -- Manifolds, vectors and

differentiation -- Energy, momentum and Einstein's equations

An Introductory Guide to Gravity and General Relativity Springer

Science & Business Media

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.

A Mathematical Exposition Springer

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.

*An Introduction to Einstein's General Relativity* Cambridge University Press

"General Relativity Without Calculus" offers a compact but mathematically correct introduction to the general theory of relativity, assuming only a basic knowledge of high school mathematics and physics. Targeted at first year undergraduates (and advanced high school students) who wish to learn Einstein's theory beyond popular science accounts, it covers the basics of special relativity, Minkowski space-time, non-Euclidean geometry, Newtonian gravity, the Schwarzschild solution, black holes and cosmology. The quick-paced style is balanced by over 75 exercises (including full solutions), allowing readers to test and consolidate their understanding.

A Most Incomprehensible Thing OUP Oxford

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. --

From Classical Mechanics to General Relativity and Beyond Oxford University Press

This is a book about physics, written for mathematicians. The readers we have in mind can be roughly described as those who:  
1. are mathematics graduate students with some knowledge of global differential geometry  
2. have had the equivalent of

freshman physics, and find popular accounts of astrophysics and cosmology interesting 3. appreciate mathematical clarity, but are willing to accept physical motivations for the mathematics in place of mathematical ones 4. are willing to spend time and effort mastering certain technical details, such as those in Section 1. 1. Each book disappoints some readers. This one will disappoint: 1. physicists who want to use this book as a first course on differential geometry 2. mathematicians who think Lorentzian manifolds are wholly similar to Riemannian ones, or that, given a sufficiently good mathematical background, the essentials of a subject like cosmology can be learned without some hard work on boring details 3. those who believe vague philosophical arguments have more than historical and heuristic significance, that general relativity should somehow be "proved," or that axiomatization of this subject is useful 4. those who want an encyclopedic treatment (the books by Hawking-Ellis [1], Penrose [1], Weinberg [1], and Misner-Thorne-Wheeler [1] go further into the subject than we do; see also the survey article, Sachs-Wu [1]). 5. mathematicians who want to learn quantum physics or unified field theory (unfortunately, quantum physics texts all seem either to be for physicists, or merely concerned with formal mathematics).

A First Course in General Relativity Springer Nature

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.

**Gravity from the Ground Up** Cambridge University Press

A presentation of general relativity as a scheme for describing

the gravitational field and the equations it obeys. Starting from physical motivations, curved co-ordinates are introduced, and then the notion of an affine connection field is added. At a later step, the metric field is added.

General Relativity and the Einstein Equations Cambridge University Press

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.

Geometrical Methods of Mathematical Physics Cambridge University Press

The theory of relativity is tackled directly in this book, dispensing with the need to establish the insufficiency of Newtonian mechanics. This book takes advantage from the start of the geometrical nature of the relativity theory. The reader is assumed to be familiar with vector calculus in ordinary three-dimensional Euclidean space.

*The Perfect Theory* 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.

*A Course for Undergraduate Students of Physics* Oxford University Press, USA

Following the approach of Lev Landau and Evgenii Lifshitz, this book introduces the theory of special and general relativity with the Lagrangian formalism and the principle of least action. This method allows the complete theory to be constructed starting from a small number of assumptions, and is the most natural approach in modern theoretical physics. The book begins by reviewing Newtonian mechanics and Newtonian gravity with the Lagrangian formalism and the principle of least action, and then moves to special and general relativity. Most calculations are presented step by step, as is done on the board in class. The book covers recent advances in gravitational wave astronomy and provides a general overview of current lines of research in

gravity. It also includes numerous examples and problems in each chapter.

**The General Theory of Relativity** Springer Science & Business Media

This book provides an in-depth and accessible description of special relativity and quantum mechanics which together form the foundation of 21st century physics. A novel aspect is that symmetry is given its rightful prominence as an integral part of this foundation. The book offers not only a conceptual understanding of symmetry, but also the mathematical tools necessary for quantitative analysis. As such, it provides a valuable precursor to more focused, advanced books on special relativity or quantum mechanics. Students are introduced to several topics not typically covered until much later in their education. These include space-time diagrams, the action principle, a proof of Noether's theorem, Lorentz vectors and tensors, symmetry breaking and general relativity. The book also provides extensive descriptions on topics of current general interest such as gravitational waves, cosmology, Bell's theorem, entanglement and quantum computing. Throughout the text, every opportunity is taken to emphasize the intimate connection between physics, symmetry and mathematics. The style remains light despite the rigorous and intensive content. The book is intended as a stand-alone or supplementary physics text for a one or two semester course for students who have completed an introductory calculus course and a first-year physics course that includes Newtonian mechanics and some electrostatics. Basic knowledge of linear algebra is useful but not essential, as all requisite mathematical background is provided either in the body

of the text or in the Appendices. Interspersed through the text are well over a hundred worked examples and unsolved exercises for the student.

All the Mathematics You Missed CRC Press

A straightforward, enjoyable guide to the mathematics of Einstein's relativity. To really understand Einstein's theory of relativity – one of the cornerstones of modern physics – you have to get to grips with the underlying mathematics. This self-study guide is aimed at the general reader who is motivated to tackle that not insignificant challenge. With a user-friendly style, clear step-by-step mathematical derivations, many fully solved problems and numerous diagrams, this book provides a comprehensive introduction to a fascinating but complex subject. For those with minimal mathematical background, the first chapter gives a crash course in foundation mathematics. The reader is then taken gently by the hand and guided through a wide range of fundamental topics, including Newtonian mechanics; the Lorentz transformations; tensor calculus; the Einstein field equations; the Schwarzschild solution (which gives a good approximation of the spacetime of our Solar System); simple black holes, relativistic cosmology and gravitational waves. Special relativity helps explain a huge range of non-

gravitational physical phenomena and has some strangely counter-intuitive consequences. These include time dilation, length contraction, the relativity of simultaneity, mass-energy equivalence and an absolute speed limit. General relativity, the leading theory of gravity, is at the heart of our understanding of cosmology and black holes. "I must observe that the theory of relativity resembles a building consisting of two separate stories, the special theory and the general theory. The special theory, on which the general theory rests, applies to all physical phenomena with the exception of gravitation; the general theory provides the law of gravitation and its relations to the other forces of nature." – Albert Einstein, 1919. Understand even the basics of Einstein's amazing theory and the world will never seem the same again. Contents: Preface Introduction 1 Foundation mathematics 2 Newtonian mechanics 3 Special relativity 4 Introducing the manifold 5 Scalars, vectors, one-forms and tensors 6 More on curvature 7 General relativity 8 The Newtonian limit 9 The Schwarzschild metric 10 Schwarzschild black holes 11 Cosmology 12 Gravitational waves Appendix: The Riemann curvature tensor Bibliography Acknowledgements January 2019. This third edition has been revised to make the material even more accessible to the enthusiastic general reader who seeks to understand the mathematics of relativity.