

The Mathematical Theory Of Special And General Relativity

Einstein's Space-Time Differential Geometry and General Relativity Relativity The Physical and Mathematical Foundations of the Theory of Relativity Einstein, Hilbert, and The Theory of Gravitation Relativity FUNDAMENTALS OF SPECIAL AND GENERAL RELATIVITY, Revised Edition A Mathematical Journey to Relativity Special & General Relativity (Concise Edition) The Attraction of Gravitation The Geometry of Spacetime General Relativity Group Theory and General Relativity Special and General Relativity: An Introduction to Spacetime and Gravitation General Relativity and the Einstein Equations The Mathematical Theory of Special and General Relativity Introduction To General Relativity The Principle of Relativity Spacetime and Geometry: An Introduction to General Relativity General Relativity Rafael Ferraro Canbin Liang Albert Einstein Antonio Romano Jagdish Mehra Hans Stephani KRORI, K. D. Wladimir-Georges Boskoff Albert Einstein John Earman James J. Callahan Norbert Straumann Moshe Carmeli Rainer Dick Yvonne Choquet-Bruhat Ashok N. Katti John Dirk Walecka Hendrik Antoon Lorentz Sean Carroll M. P. Hobson

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this excellent textbook offers a unique take on relativity theory setting it in its historical context ideal for those interested in relativity and the history of physics the book contains a complete account of special relativity that begins with the historical analysis of the reasons that led to a change in our view of space and time its aim is to foster a deep understanding of relativistic spacetime and its consequences for dynamics

this book the first in a three volume set explains general relativity using the mathematical tool of differential geometry the book consists of ten chapters the first five of which introduce differential geometry which is widely applicable even outside the field of relativity chapter 6 analyzes special relativity using geometric language in turn the last four chapters introduce readers to the fundamentals of general relativity intended for beginners this volume includes numerous exercises and worked out example in each chapter to facilitate the learning experience chiefly written for graduate level courses the book s content will also benefit upper level undergraduate students and can be used as a reference guide for practicing theoretical physicists

this book contains the great physicist's own explanation of both the special and general theories of relativity written for readers interested in the theory but not conversant with the mathematical apparatus of theoretical physics it presents the ideas in their simplest most intelligible form

this unique textbook offers a mathematically rigorous presentation of the theory of relativity emphasizing the need for a critical analysis of the foundations of general relativity in order to best study the theory and its implications the transitions from classical mechanics to special relativity and then to general relativity are explored in detail as well helping readers to gain a more profound and nuanced understanding of the theory as a whole after reviewing the fundamentals of differential geometry and classical mechanics the text introduces special relativity first using the physical approach proposed by Einstein and then via Minkowski's mathematical model the authors then address the relativistic thermodynamics of continua and electromagnetic fields in matter topics which are normally covered only very briefly in other treatments in the next two chapters the text then turns to a discussion of general relativity by means of the authors unique critical approach underlining the difficulty of recognizing the physical meaning of some statements such as the physical meaning of coordinates and the derivation of physical quantities from those of space time chapters in this section cover the model of space time proposed by Schwarzschild black holes the Friedman equations and the different cosmological models they describe and the Fermi-Walker derivative well suited for graduate students in physics and mathematics who have a strong foundation in real analysis classical mechanics and general physics this textbook is appropriate for a variety of graduate level courses that cover topics in relativity additionally it will interest physicists and other researchers who wish to further study the subtleties of these theories and understand the contemporary scholarly discussions surrounding them

some time ago i published a small piece dealing with a charming little essay on the state of ether in magnetic fields which the sixteen year old Einstein had written while he was awaiting admission to the ETH in Zurich this paper sought to trace the continuity between Einstein's early interest in electrodynamics and his later work on the special and general relativity theories on reading this paper professor Eugene Wigner asked me whether David Hilbert had not independently discovered the field equations of gravitation his impression from his stay in Göttingen where Wigner had been Hilbert's assistant for one year in the late nineteen twenties was that Hilbert had indeed done so and he asked me if it was true i replied to professor Wigner about Hilbert's contribution to the theory of gravitation that he kindly encouraged me to expand my account to deal with the intricate and exciting details of the early years in the formulation of the general relativity theory of gravitation this is what i have sought to do in this study Albert Einstein created the general relativity theory of gravitation and dominated its development through the rest of his life his early work on the theory of gravitation from 1912 to 1916 had the drama of high adventure it culminated in the establishment of its foundations which have remained unassailed by the theoretical and experimental work of succeeding decades

thoroughly revised and updated this textbook provides a pedagogical introduction to relativity it is self contained but the reader is expected to have a basic knowledge of theoretical mechanics and electrodynamics it covers the most important features of both special and general relativity as well as touching on more difficult topics such as the field of charged pole dipole particles the Petrov classification groups of motions gravitational lenses exact solutions and the structure of infinity the necessary mathematical tools tensor calculus Riemannian geometry are provided most of the derivations are given in full and exercises are included where appropriate written as a textbook for undergraduate and introductory graduate courses it will also be of use to researchers working in the field the bibliography gives the original papers and directs the reader to useful monographs and review papers

relativity apart from quantum mechanics is the greatest wonder in science unfolded single handedly in the 20th century by Albert Einstein the scientist developed

general relativity as a logical sequel to special relativity this comprehensive book presents explication of the conceptual evolution and mathematical derivations of the theories of special and general relativity the book follows an einsteinian approach while explaining the concepts and the theories of relativity divided into 14 chapters the revised edition of the book covers elementary concepts of special relativity as well as the advanced studies on general relativity the recent theories like kerr geometry sagnac effect vaidya geometry raychaudhuri equation and gravitation physics vis à vis quantum physics are presented in easy to understand language and simple style in addition to it the book gives an in depth analysis on the applications of advanced theories like vaidya krori barua solution from author s own research works apart from that the book also discusses some of the isotropic and anisotropic cosmological models in detail the salient topics discussed in the revised edition of the book are extrinsic curvature detection of gravitational waves early universe evolution of a dead star into a white dwarf or a neutron star or a black hole dark matter and dark energy this book is intended for the undergraduate and postgraduate students of physics and mathematics key features step by step derivation of equations easy demagogic approach review questions to widen the analytical understanding of the students

this book opens with an axiomatic description of euclidean and non euclidean geometries euclidean geometry is the starting point to understand all other geometries and it is the cornerstone for our basic intuition of vector spaces the generalization to non euclidean geometry is the following step to develop the language of special and general relativity these theories are discussed starting from a full geometric point of view differential geometry is presented in the simplest way and it is applied to describe the physical world the final result of this construction is deriving the einstein field equations for gravitation and spacetime dynamics possible solutions and their physical implications are also discussed the schwarzschild metric the relativistic trajectory of planets the deflection of light the black holes the cosmological solutions like de sitter friedmann lemaître robertson walker and gödel ones some current problems like dark energy are also sketched the book is self contained and includes details of all proofs it provides solutions or tips to solve problems and exercises it is designed for undergraduate students and for all readers who want a first geometric approach to special and general relativity

einstein s pioneering work helped shape the cultural landscape of the world today now in a digestible pocket format for the modern reader a new popular edition with a clear introduction special general relativity by albert einstein contains his core paper relativity the special the general theory a popular exposition which established his reputation as one of the greatest thinkers of our and perhaps any age also included are two of the princeton university lectures he gave to explain his findings in more detail on the meaning of relativity as well as the early paper which led to his famous equation $E=mc^2$ the flame tree foundations series features core publications which together have shaped the cultural landscape of the modern world with cutting edge research distilled into pocket guides designed to be both accessible and informative

devoted to the history of general relativity this text provides reviews from scholars all over the world many of the papers originated at the third international conference on the history of general relativity held at the university of pittsburgh in the summer of 1991 topics covered include disputes with einstein the empirical basis of general relativity variational principles in general relativity the reception and development of general relativity and cosmology and general relativity

hermann minkowski recast special relativity as essentially a new geometric structure for spacetime this book looks at the ideas of both einstein and minkowski and then introduces the theory of frames surfaces and intrinsic geometry developing the main implications of einstein s general relativity theory

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

this is the only book on the subject of group theory and einstein s theory of gravitation it contains an extensive discussion on general relativity from the viewpoint of group theory and gauge fields it also puts together in one volume many scattered original works on the use of group theory in general relativity theory there are twelve chapters in the book the first six are devoted to rotation and lorentz groups and their representations they include the spinor representation as well as the infinite dimensional representations the other six chapters deal with the application of groups particularly the lorentz and the $sl(2, \mathbb{C})$ groups to the theory of general relativity each chapter is concluded with a set of problems the topics covered range from the fundamentals of general relativity theory its formulation as an $sl(2, \mathbb{C})$ gauge theory to exact solutions of the einstein gravitational field equations the important bondi metzner sachs group and its representations conclude the book the entire book is self contained in both group theory and general relativity theory and no prior knowledge of either is assumed the subject of this book constitutes a relevant link between field theoreticians and general relativity theoreticians who usually work rather independently of each other the treatise is highly topical and of real interest to theoretical physicists general relativists and applied mathematicians it is invaluable to graduate students and research workers in quantum field theory general relativity and elementary particle theory

this book provides a concise introduction to the special theory of relativity and the general theory of relativity the format has been chosen to provide the basis for a single semester course that can take the students all the way from the foundations of special relativity to the core results of general relativity the einstein equation and the equations of motion for particles and light in curved spacetime to facilitate access to the topics of special and general relativity for science and engineering students without prior training in relativity or geometry the relevant geometric notions are also introduced

general relativity has passed all experimental and observational tests to model the motion of isolated bodies with strong gravitational fields though the mathematical and numerical study of these motions is still in its infancy it is believed that general relativity models our cosmos with a manifold of dimensions possibly greater than four and debatable topology opening a vast field of investigation for mathematicians and physicists alike remarkable conjectures have been proposed many results have been obtained but many fundamental questions remain open in this monograph aimed at researchers in mathematics and physics the author overviews the basic ideas in general relativity introduces the necessary mathematics and discusses some of the key open questions in the field

this book presents the basic theory of relativity in a rational and simplest possible manner with the emphasis on the principle of simplicity in developing the theory the presentation is in the style of a discussion and is generally devoid of unproven and speculative assertions in rare cases where speculative ideas are mentioned they are clearly stated to be such test results verifying all of the theoretical results are given and discussed this work is intended to serve as a resource and reference book for educational purposes in parts i and ii the principal results of special and general relativity are derived rigorously discussing the contributions of einstein as well as lorentz poincare minkowski hilbert eddington and others with historical notes touching upon the various aspects of relativity multiple derivations are given particularly of the mass energy relation the gravitational field equation and the relativistic orbit of planets the schwarzschild metric and its consequences leading to the formation of black holes are treated in detail the historical problems of physical dilation of time and einstein s clock paradox are treated in an entirely new

manner based upon general relativity the author has also presented einstein s gravitational radiation theory and its application by peters and mathews to radiation from orbiting bodies followed by the study of radiation from a certain binary pulsar by weisberg and taylor these difficult topics are treated without taking shortcuts as is commonly done in textbooks but in a manner that senior students can understand a fresh look is taken of weyl s unification of gravitational and electromagnetic field theories again a difficult topic avoided by textbooks the final chapter of part ii is on the elements of field cosmology aspects involving particle physics are not covered because they cannot be treated even cursorily in a book of this size dealing primarily with fields only books specializing in cosmology can do justice to that vast subject part iii is devoted entirely to tensor calculus and its application to the geometries of riemann and weyl these are the essential tools of einstein s and weyl s theories treated in part ii finally four appendices are provided on certain mathematical topics thus the book is self contained the book contains 11 figures an extensive bibliography and an index note 1 mathematical and other errors corrected march 21 2015 2 for earlier versions a pdf of mathematical errata will be emailed upon request for free 3 comments of readers are welcome and may be emailed to ashkatti34 gmail com

a working knowledge of einstein s theory of general relativity is an essential tool for every physicist today this self contained book is an introductory text on the subject aimed at first year graduate students or advanced undergraduates in physics that assumes only a basic understanding of classical lagrangian mechanics the mechanics problem of a point mass constrained to move without friction on a two dimensional surface of arbitrary shape serves as a paradigm for the development of the mathematics and physics of general relativity after reviewing special relativity the basic principles of general relativity are presented and the most important applications are discussed the final special topics section guides the reader through a few important areas of current research this book will allow the reader to approach the more advanced texts and monographs as well as the continual influx of fascinating new experimental results with a deeper understanding and sense of appreciation

spacetime and geometry an introduction to general relativity provides a lucid and thoroughly modern introduction to general relativity for advanced undergraduates and graduate students it introduces modern techniques and an accessible and lively writing style to what can often be a formal and intimidating subject readers are led from physics of flat spacetime special relativity through the intricacies of differential geometry and einstein s equations and on to exciting applications such as black holes gravitational radiation and cosmology subtle points are illuminated throughout the text by careful and entertaining exposition a straightforward and lucid approach balancing mathematical rigor and physical insight are hallmarks of this important text the full text downloaded to your computer with ebooks you can search for key concepts words and phrases make highlights and notes as you study share your notes with friends ebooks are downloaded to your computer and accessible either offline through the bookshelf available as a free download available online and also via the ipad and android apps upon purchase you ll gain instant access to this ebook time limit the ebooks products do not have an expiry date you will continue to access your digital ebook products whilst you have your bookshelf installed

general relativity an introduction for physicists provides a clear mathematical introduction to einstein s theory of general relativity it presents a wide range of applications of the theory concentrating on its physical consequences after reviewing the basic concepts the authors present a clear and intuitive discussion of the mathematical background including the necessary tools of tensor calculus and differential geometry these tools are then used to develop the topic of special relativity and to discuss electromagnetism in minkowski spacetime gravitation as spacetime curvature is then introduced and the field equations of general relativity derived after applying the theory to a wide range of physical situations the book concludes with a brief discussion of classical field theory and the derivation of general relativity from a variational principle written for advanced undergraduate and graduate students this approachable textbook contains over 300 exercises to

illuminate and extend the discussion in the text

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