



# General Relativity And Gravitational Waves

**Wei-tou Ni**



## General Relativity And Gravitational Waves:

**General Relativity and Gravitational Waves** Sanjeev Dhurandhar, Sanjit Mitra, 2022-02-16 This book serves as a textbook for senior undergraduate students who are learning the subject of general relativity and gravitational waves for the first time Both authors have been teaching the course in various forms for a few decades and have designed the book as a one stop book at basic level including derivations and exercises A spectacular prediction of general relativity is gravitational waves Gravitational waves were first detected by the LIGO detectors in 2015 hundred years after their prediction Both authors are part of the LIGO Science Collaboration and were authors on the discovery paper Therefore a strong motivation for this book is to provide the essential concepts of general relativity theory and gravitational waves with their modern applications to students and to researchers who are new to the multi disciplinary field of gravitational wave astronomy One of the advanced topics covered in this book is the fundamentals of gravitational wave data analysis filling a gap in textbooks on general relativity The topic blends smoothly with other chapters in the book not only because of the common area of research but it uses similar differential geometric and algebraic tools that are used in general relativity General Relativity and Gravitational Waves Joseph Weber, 1961 *One Hundred Years Of General Relativity: From Genesis And Empirical Foundations To Gravitational Waves, Cosmology And Quantum Gravity - Volume 1* Wei-tou Ni, 2017-05-26 The aim of this two volume title is to give a comprehensive review of one hundred years of development of general relativity and its scientific influences This unique title provides a broad introduction and review to the fascinating and profound subject of general relativity its historical development its important theoretical consequences gravitational wave detection and applications to astrophysics and cosmology The series focuses on five aspects of the theory The first three topics are covered in Volume 1 and the remaining two are covered in Volume 2 While this is a two volume title it is designed so that each volume can be a standalone reference volume for the related topic *General Relativity and Gravitational Waves* Joseph Weber, 2004-01-01 An internationally famous physicist and electrical engineer the author of this text was a pioneer in the investigation of gravitational waves Joseph Weber's *General Relativity and Gravitational Waves* offers a classic treatment of the subject Appropriate for upper level undergraduates and graduate students this text remains ever relevant Brief but thorough in its introduction to the foundations of general relativity it also examines the elements of Riemannian geometry and tensor calculus applicable to this field Approximately a quarter of the contents explores theoretical and experimental aspects of gravitational radiation The final chapter focuses on selected topics related to general relativity including the equations of motion unified field theories Friedman's solution of the cosmological problem and the Hamiltonian formulation of general relativity Exercises Index *General Relativity and Gravitational Waves* J (Joseph) 1919- Weber, 2021-09-09 This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it This work is in the public domain in the United States of America and possibly other nations Within the United States you

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**Advanced General Relativity** Claude Barrabès, Peter A. Hogan, 2013-05-23 This book is aimed at students making the transition from a first course on general relativity to a specialized subfield It presents a variety of topics under the general headings of gravitational waves in vacuo and in a cosmological setting equations of motion and black holes all having a clear physical relevance and a strong emphasis on space time geometry Each chapter could be used as a basis for an early postgraduate project for those who are exploring avenues into research in general relativity and who have already accumulated the required technical knowledge The presentation of each chapter is research monograph style rather than text book style in order to impress on interested students the need to present their research in a clear and concise format Students with advanced preparation in general relativity theory might find a treasure trove here

**General Relativity and Gravitation**, 1986 *Gravity* James B. Hartle, 2021-06-24 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

**General Relativity and its Applications** Valeria Ferrari, Leonardo Gualtieri, Paolo Pani, 2020-12-22 Containing the latest groundbreaking discoveries in the field this text outlines the basics of Einstein's theory of gravity with a focus on its most important astrophysical consequences including stellar structures black holes and the physics of gravitational waves Blending advanced topics usually not found in introductory textbooks with examples pedagogical boxes mathematical tools and practical applications of the theory this textbook maximises learning opportunities and is ideal for master and graduate students in Physics and Astronomy Key features Provides a self contained and consistent treatment of the subject that does not require advanced previous knowledge of the field Explores the subject with a new focus on gravitational waves and astrophysical relativity unlike current introductory textbooks Fully up to date containing the latest developments and discoveries in the field

**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

**Proceedings of the 16th International Conference on General Relativity & Gravitation** Nigel Bishop, Sunil D. Maharaj, 2002 The 16th conference of the International Society on General Relativity and Gravitation GR16 held at the International Convention Centre in Durban South Africa from 15 to 21 July was attended by 450 delegates from around the world The scientific programme comprised 18 plenary lectures one public lecture and 19 workshops which excepting three plenary lectures are presented in this proceedings It was the first major international conference on general relativity and gravitation held on the African continent

General Relativity and Gravitational Waves J. Weber, 2013-09 Upper Level Undergraduates And Graduate Students Receive A Brief But Thorough Introduction To The Foundations Of General Relativity From A Pioneer In The Investigation Of Gravitational Waves Who Introduces The Related Riemannian Geometry And Tensor Calculus Conservation Laws And Classic Experiments

*Histoire des persecutions et guerre faites depuis 1555 jusqu'en 1561, contre le peuple appelé Vaudois, etc*, 1562

*Theory and Experiment in Gravitational Physics* Clifford M. Will, 2018-09-27 A comprehensive review of the testing and research conducted on Einstein's theory of general relativity

**One Hundred Years of General Relativity** Wei-Tou Ni, 2017 The aim of this two volume title is to give a comprehensive review of one hundred years of development of general relativity and its scientific influences This unique title provides a broad introduction and review to the fascinating and profound subject of general relativity its historical development its important theoretical consequences gravitational wave detection and applications to astrophysics and cosmology The series focuses on five aspects of the theory Genesis Solutions and Energy Empirical Foundations Gravitational Waves Cosmology Quantum Gravity The first three topics are covered in Volume 1 and the remaining two are covered in Volume 2 While this is a two volume title it is designed so that each volume can be a stand alone reference volume for the related topic Page 4 of cover

General Relativity and John Archibald Wheeler Ignazio Ciufolini, Richard A. Matzner, 2010-06-22 Observational and experimental data pertaining to gravity and cosmology are changing our view of the Universe General relativity is a fundamental key for the understanding of these observations and its theory is undergoing a continuing enhancement of its intersection with observational and experimental data These data include direct observations and experiments carried out in our solar system among which there are direct gravitational wave astronomy frame dragging and tests of gravitational theories from solar system and spacecraft observations This book explores John Archibald Wheeler's seminal and enduring contributions in relativistic astrophysics and includes the General Theory of Relativity and Wheeler's influence recent developments in the confrontation of relativity with experiments the theory describing gravitational radiation and its detection in Earth based and space based interferometer detectors as well as in Earth based bar detectors the mathematical

description of the initial value problem in relativity and applications to modeling gravitational wave sources via computational relativity the phenomenon of frame dragging and its measurement by satellite observations All of these areas were of direct interest to Professor John A Wheeler and were seminally influenced by his ideas

**Advanced General Relativity** Claude Barrabès, Peter A. Hogan, 2013-05-23 The book covers mainstream topics at research level involving gravitational waves spinning particles and black holes suitable for graduates and early postgraduates exploring avenues into research in general relativity

*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

**General Relativity and Gravitational Physics** Giampiero Esposito, 2005-03-29 All papers were peer reviewed Research advances in gravitation and general relativity are discussed ranging from classical to quantum theories of gravity Relativistic theories have become the basic model for new research fields encompassing important experiments and observations which represent a frontier on which Einstein's theory of gravity can be tested This will provide some new insight into the field of gravitational physics The proceedings will be a valuable source for advanced graduate students and research workers at all levels

**Interacting Gravitational, Electromagnetic, Neutrino And Other Waves: In The Context Of Einstein's General Theory Of Relativity** Anzhong Wang, 2020-03-19 This book is devoted to researchers who would like to investigate interactions among gravitational waves and matter fields beyond linear order including the phenomena of memory effects gravitational Faraday rotation soft theorems and formations of spacetime singularities due to the mutual focus of gravitational waves Readers only require a basic understanding of general relativity to understand the materials The book starts with an overview on the fundamentals of the Newman Penrose formalism and a brief introduction to distribution theory with which the author systematically develops a mathematical description of spacetimes of colliding plane waves Then the author presents a frame independent definition of polarization of a plane gravitational wave in a curved spacetime studies in detail the gravitational Faraday rotation of two plane gravitational waves and shows that each of them can serve as a medium to the other precisely due to their nonlinear interactions Exact solutions are also presented which represent a variety of models including the collisions of two plane gravitational waves and the collisions of a plane gravitational wave with a dust shell a massless scalar wave an electromagnetic wave or a neutrino wave The formation of spacetime singularities due to nonlinear interactions and the effects of gravitational wave polarization on the nature of singularities are also explored

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