

Lorentzian Wormholes From Einstein To Hawking Aip Series In Computational And Applied Mathematical Physics

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*Trends in General Relativity and Quantum
Cosmology* - Charles V. Benton 2006

Cosmology deals with the nature of the universe. It can be broadly divided into three great ages. The first began in the 6th century BC with the Pythagorean concept of a spherical Earth that is part of a universe in which the motions of the planets are governed by the harmonious relations of natural laws. The second began in the 16th century with the Copernican revolution. This in turn led into Newton's infinite universe. The third began in the early 20th century with Albert Einstein's theory of general relativity and developed into the expanding universe we know today. Einstein's general theory of relativity extended the new space and time concepts of the special theory of relativity from the domain of electric and magnetic phenomena to all of physics and, particularly, to the theory of gravitation. By building on Einstein's previous work on special relativity, general relativity sought to deal with accelerating frames of

reference. This in turn led to the principle of equivalence. By dealing with accelerating frames of reference, general relativity provides astronomers with the best theory to predict the effects of gravity. This book examines in detail new and important work in this field.

The Twelfth Marcel Grossmann Meeting -
Thibault Damour 2012-02-02

Marcel Grossmann Meetings are formed to further the development of General Relativity by promoting theoretical understanding in the fields of physics, mathematics, astronomy and astrophysics and to direct future technological, observational, and experimental efforts. In these meetings are discussed recent developments in classical and quantum gravity, general relativity and relativistic astrophysics, with major emphasis on mathematical foundations and physical predictions, with the main objective of gathering scientists from diverse backgrounds for deepening the understanding of spacetime structure and reviewing the status of test-

experiments for Einstein's theory of gravitation. The range of topics is broad, going from the more abstract classical theory, quantum gravity and strings, to the more concrete relativistic astrophysics observations and modeling. The three volumes of the proceedings of MG12 give a broad view of all aspects of gravitational physics and astrophysics, from mathematical issues to recent observations and experiments. The scientific program of the meeting includes 29 plenary talks stretched over 6 mornings, and 74 parallel sessions over 5 afternoons. Volume A contains plenary and review talks ranging from the mathematical foundations of classical and quantum gravitational theories including recent developments in string theories, to precision tests of general relativity including progress towards the detection of gravitational waves, to relativistic astrophysics including such topics as gamma ray bursts, black hole physics both in our galaxy, in active galactic nuclei and in other galaxies, neutron stars, pulsar astrophysics,

gravitational lensing effects, neutrino physics and ultra high energy cosmic rays. The rest of the volumes include parallel sessions on dark matter, neutrinos, X-ray sources, astrophysical black holes, neutron stars, binary systems, radiative transfer, accretion disks, alternative gravitational theories, perturbations of collapsed objects, analog models, black hole thermodynamics, cosmic background radiation & observational cosmology, numerical relativity & algebraic computing, gravitational lensing, variable "constants" of nature, large scale structure, topology of the universe, brane-world cosmology, early universe models & cosmic microwave background anisotropies, inhomogeneous cosmology, inflation, gamma ray burst modeling, supernovas, global structure, singularities, cosmic censorship, chaos, Einstein-Maxwell systems, inertial forces, gravitomagnetism, wormholes & time machines, exact solutions of Einstein's equations, gravitational waves, gravitational wave detectors

& data analysis, precision gravitational measurements, history of relativity, quantum gravity & loop quantum gravity, Casimir effect, quantum cosmology, strings & branes, self-gravitating systems, gamma ray astronomy, cosmic rays, gamma ray bursts and quasars. Sample Chapter(s) Space-Time from the Spectral Point of View (467k) Contents: Space-Time from the Spectral Point of View (Ali H Chamseddine and Alain Connes)The Formation of Black Holes in General Relativity (Demetrios Christodoulou)Matching Conditions in Relativistic Astrophysics (Hernando Quevedo)Black Holes as a Source of Information (Juan Maldacena)Black Hole Microstate Counting and Its Macroscopic Counterpart (Ipsita Mandal and Ashoke Sen)Transplanckian String Collisions: An Update (Gabriele Veneziano)Ultraviolet Divergences and Scale-Dependent Gravitational Couplings (Herbert W Hamber)The Black Hole Stability Problem for Linear Scalar Perturbations (Mihalis Dafermos

and Igor Rodnianski)The Global Network of Laser Interferometer Gravitational Wave Detectors (David H Reitze)Analytical Relativity of Black Holes (Thibault Damour)Detection of Gravitational Waves Using Pulsar Timing (Richard N Manchester)Relativistic Spin-Precession in Binary Pulsars (Michael Kramer)Supernovae and Gamma-Ray Bursts: 10 Years of Observations (Massimo Della Valle)Gamma-Ray Bursts as Relativistic Objects (Tsvi Piran)Fundamental Physics from Black Holes, Neutron Stars and Gamma-Ray Bursts (Remo Ruffini)The Fascinating TeV Sky (Felix Aharonian)Galaxy Clusters and Their Central Supermassive Black Holes: Case of M87 (Eugene Churazov, Sergey Sazonov, Rashid Sunyaev, William Forman, Christine Jones and Hans Böhringer)Intergalactic Shock Fronts (Maxim Markevitch)Studies of Dark Energy with X-Ray Observations of Galaxy Clusters (Alexey Vikhlinin)and other papers Keywords:General Relativity;Gravitation;Astrophysics;Quantum

Gravity;Particle Physics;Cosmology;Theoretical Physics

The General Theory of Relativity - Farook Rahaman 2021-09-30

The book aims to expound the general theory of relativity with a mathematical point of view. Catering to the needs of postgraduate students and researchers in the field of astrophysics and mathematical physics, it offers the readers a comprehensive understanding of the advanced topics of the subject matter. It specifically discusses the mathematical foundation of tensor calculus, gives a background of geodesics, Einstein's field equations, linearised gravity, spacetime of spherically symmetric distribution of matter and black holes, and particle and photon orbits in spacetime. Apart from the formulation of general relativity, Lie derivatives and its applications, and causality of spacetime are also discussed in detail. Certain preliminary concepts of extrinsic curvature, Lagrangian formalism of general theory of relativity and 3 +

1 decomposition of space-time are covered and are provided in the book as appendices.

Time Travel - Nikk Effingham 2020-02-20

There are various arguments for the metaphysical impossibility of time travel. Is it impossible because objects could then be in two places at once? Or is it impossible because some objects could bring about their own existence? In this book, Nikk Effingham contends that no such argument is sound and that time travel is metaphysically possible. His main focus is on the Grandfather Paradox: the position that time travel is impossible because someone could not go back in time and kill their own grandfather before he met their grandmother. In such a case, Effingham argues that the time traveller would have the ability to do the impossible (so they could kill their grandfather) even though those impossibilities will never come about (so they won't kill their grandfather). He then explores the ramifications of this view, discussing issues in probability and decision theory. The book

ends by laying out the dangers of time travel and why, even though no time machines currently exist, we should pay extra special care ensuring that nothing, no matter how small or microscopic, ever travels in time.

Proceedings of the Ninth Conference on Quantum Field Theory Under the Influence of External Conditions (OFEXT09) - Kimball A. Milton 2010

Casimir forces between spheres and loop integrals / J. Babington -- Analytic corrections to the electromagnetic Casimir interaction between a sphere and a plate at short distances / M. Bordag and V. Nikolaev -- Casimir physics : geometry, shape and material / T. Emig -- Semitransparent pistons / P. Morales and K. Kirsten -- Using boundary methods to compute the Casimir energy / F.C. Lombardo, F.D. Mazzitelli and P.I. Villar -- Electromagnetic non-contact gears : prelude / P. Parashar [und weitere] -- The scattering approach to the Casimir force / S. Reynaud [und weitere] --

Scalar Casimir energies for separable coordinate systems : application to semi-transparent planes in an annulus / J. Wagner, K.A. Milton and K. Kirsten -- Demonstrating the strong geometry dependence of the Casimir force on a surface with deep, nanoscale corrugations / H.B. Chan [und weitere] -- New results for the Casimir interaction : sample characterization and low temperature measurements / R.S. Decca, D. Lopez and E. Osquiguil -- Casimir force experiments in air : two birds with one stone / S. De Man [und weitere] -- Experimental features of the recent lateral Casimir force measurement / H.-C. Chiu and U. Mohideen -- Lateral Casimir-Polder force measurement using Bose Einstein condensates / G.A. Moreno -- Repulsive Casimir and van der Waals forces : from measurements to future technologies / J.N. Munday and F. Capasso -- Macroscopic quantum vacuum and microscopic gravitation / R. Onofrio -- The PVLAS experiment and its results : probing the quantum vacuum with polarized light and

magnetic fields / F. Della Valle [und weitere] -- Thermal Casimir effect for conducting plates and the Bohr-van Leeuwen theorem / G. Bimonte -- Electromagnetic Casimir effect in wedge geometry and the energy-momentum tensor in media / I. Brevik, S.A. Ellingsen and K.A. Milton - - Casimir-Polder potential in thermal non-equilibrium / S.A. Ellingsen [und weitere] -- Geometry-temperature interplay in the Casimir effect / H. Gies and A. Weber -- Thermal effects in the magnetic Casimir-Polder interaction / H. Haakh, F. Intravaia and C. Henkel -- Mode contributions to the Casimir effect / F. Intravaia and C. Henkel -- Thermal Casimir force between magnetic materials / G.L. Klimchitskaya, B. Geyer and V.M. Mostepanenko -- The Casimir effect and the foundations of statistical physics / V.M. Mostepanenko and G.L. Klimchitskaya -- Casimir-Lifshitz forces and entropy / L.P. Pitaevskii -- The thermal Casimir effect : saturation / B.E. Sernelius -- Finite temperature Casimir effect in the presence of extra

dimensions / L.P. Teo and K. Kirsten -- The role of magnetoplasmons in Casimir force calculations / R. Esquivel-Sirvent [und weitere] -- Suspended graphene films and their Casimir interaction with ideal conductor / I.V. Fialkovsky -- Casimir energy of finite width mirrors : renormalization, self-interaction limit and Lifshitz formula / I.V. Fialkovsky, V.N. Markov and Yu. M. Pis'mak -- Role of surface states in the Casimir force between semiconducting films / M. Govoni, C. Calandra and A. Benassi -- On the Casimir entropy between "perfect crystals" / C. Henkel and F. Intravaia -- Theory of the Casimir effect for gratings / V.N. Marachevsky
NASA Breakthrough Propulsion Physics Workshop Proceedings - 1999

Acta Physica Polonica - 1999

Theoretical Frontiers in Black Holes and Cosmology - Renata Kallosh 2016-07-16
These lecture notes are dedicated to the most

recent theoretical applications of Black Hole solutions in high-energy physics. The main motivation of this volume is to present the latest black hole backgrounds that are relevant for gauge/gravity correspondence. Leading scientists in the field explain effective techniques for finding singular and cosmological solutions embedded in gauged supergravity, shedding light on underlying properties and symmetries. Starting from a basic level, the mathematical structures underlying black holes and cosmologies are revealed, helping the reader grasp the connection between theoretical approaches and physical observations with insights into possible future developments from both a theoretical and experimental point of view. The topics covered in this volume are based on lectures delivered during the “Theoretical Frontiers in Black Holes and Cosmology” school, held in Natal in June 2015. *The Future of the Universe and the Future of Our Civilization* - V. Burdyuzha 2000

The first of its kind, the Symposium on the Future of the Universe and the Future of our Civilization examined the current status and future evolution of the Universe, the Galaxy, the stars and the Sun. Among the major subjects of discussion were: (1) How was our Universe born? (2) How do the Sun and the stars evolve? (3) What is the destiny of the solar system and the Universe? (4) What are the origins and the future of the biosphere of the Earth? (5) What are the prospects of survival of human civilization? Special attention was devoted to analysis of humanitarian and philosophical problems of evolution of humankind on the planet Earth and in the Universe. Among them were methodological, economic, sociological and medical aspects of the progress of civilization. Scientists from different countries put forward some practical proposals, including those describing the possible ways out of the systemic crisis of our civilization. Frontiers of Propulsion Science - Marc G. Millis

2009

"Frontiers of Propulsion Science" is the first-ever compilation of emerging science relevant to such notions as space drives, warp drives, gravity control, and faster-than-light travel the kind of breakthroughs that would revolutionize spaceflight and enable human voyages to other star systems. Although these concepts might sound like science fiction, they are appearing in growing numbers in reputable scientific journals.

Fourteenth Marcel Grossmann Meeting, The: On Recent Developments In Theoretical And Experimental General Relativity, Astrophysics, And Relativistic Field Theories - Proceedings Of The Mg14 Meeting On General Relativity (In 4 Parts) - Massimo Bianchi 2017-10-13

The four volumes of the proceedings of MG14 give a broad view of all aspects of gravitational physics and astrophysics, from mathematical issues to recent observations and experiments. The scientific program of the meeting included

35 morning plenary talks over 6 days, 6 evening popular talks and 100 parallel sessions on 84 topics over 4 afternoons. Volume A contains plenary and review talks ranging from the mathematical foundations of classical and quantum gravitational theories including recent developments in string theory, to precision tests of general relativity including progress towards the detection of gravitational waves, and from supernova cosmology to relativistic astrophysics, including topics such as gamma ray bursts, black hole physics both in our galaxy and in active galactic nuclei in other galaxies, and neutron star, pulsar and white dwarf astrophysics. The remaining volumes include parallel sessions which touch on dark matter, neutrinos, X-ray sources, astrophysical black holes, neutron stars, white dwarfs, binary systems, radiative transfer, accretion disks, quasars, gamma ray bursts, supernovas, alternative gravitational theories, perturbations of collapsed objects, analog models, black hole thermodynamics,

numerical relativity, gravitational lensing, large scale structure, observational cosmology, early universe models and cosmic microwave background anisotropies, inhomogeneous cosmology, inflation, global structure, singularities, chaos, Einstein-Maxwell systems, wormholes, exact solutions of Einstein's equations, gravitational waves, gravitational wave detectors and data analysis, precision gravitational measurements, quantum gravity and loop quantum gravity, quantum cosmology, strings and branes, self-gravitating systems, gamma ray astronomy, cosmic rays and the history of general relativity.

Back-in-Time and Faster-than-Light Travel in General Relativity - Serguei Krasnikov
2018-05-10

For the past 20 years causality violations and superluminal motion have been the object of intensive study as physical and geometrical phenomena. This book compiles the results of its author and also reviews other work in the field.

In particular, the following popular questions are addressed: Is causality protected by quantum divergence at the relevant Cauchy horizon? How much "exotic matter" would it take to create a time machine or a warp drive? What is the difference between a "discovered" time machine and a created one? Why does a time traveler fail to kill their grandfather? How should we define the speed of gravity and what is its magnitude?

Semiclassical Gravitation Theory - James Mattingly 2001

Black Holes - Kip S. Thorne 1986-01-01
A pedagogical introduction to the physics of black holes. The membrane paradigm represents the four-dimensional spacetime of the black hole's "event horizon" as a two-dimensional membrane in three-dimensional space, allowing the reader to understand and compute the behavior of black holes in complex astrophysical environments.

Quantum Bio-Informatics II -

Hypothetical Spacecraft and Interstellar Travel -

Ezekiel Nygren 2015-02-28

Hypothetical Spacecraft and Interstellar Travel collects information about the latest and greatest hypothetical spacecraft.

Ask the Experts: Astronomy - Scientific American Editors 2014-08-25

For going on two decades, Scientific American's "Ask the Experts" column has been answering reader questions on all fields of science. We've taken your questions from the basic to the esoteric and reached out to top scientists, professors and researchers to find out why the sky is blue or whether we really only use 10% of our brains. Now, we've combed through our archives and have compiled some of the most interesting questions (and answers) into a series of eBooks. Organized by subject, each eBook provides short, easily digestible answers to questions on that particular branch of the

sciences. The second eBook in our series - Astronomy - looks skyward and explains a variety of universal phenomena and theories. Are you curious about how planets acquire rings or what creates those gorgeous spiral arms around galaxies? Or maybe you want to know why the Big Bang didn't collapse into a black hole. Astrophysicists, professors and scientists tackle questions about stars, planets, asteroids, galaxies and nebulae, the expanding universe as well as the oddities - black holes, wormholes and dark matter. Look inside and find out what we know and what we don't know about these wonders.

Newton's Principia revisited - Michael Schmiechen 2009

PROBLEM. The treatise is devoted to the reconstruction of our 'instinctive beliefs' in classical mechanics and to present them 'as much isolated and as free from irrelevant additions as possible'. The same motivation has driven many authors since the publication of

Newton's Principia. IMPORTANCE. Classical mechanics will remain the basic reference and tool for mechanics on terrestrial and planetary scale as well as the proto-theory of relativistic and quantum mechanics. But it can only serve its purpose if it is not considered as obsolete, but if its foundations and implications are understood and made 'absolutely' clear. METHOD. Based on the 'instinctive belief' that the foundations of classical mechanics cannot be found and reconstructed within mechanics itself but only 'outside', classical mechanics is 'understood' by embedding it into an adequate theory of knowledge and adequate proto- and meta-theories in terms of the 'language of dynamics'. Evidence is produced that available philosophical expositions are not adequate for the purpose at hand. Mechanics is treated as part of physics, not of mathematics. Not sophisticated mathematical artifacts, necessary for solving specific problems, but the intellectually satisfactory foundation of

mechanics in general is subject and purpose of the exercise. The goal is reached using axiomatic systems as models. SCOPE. Following an account of the unsatisfactory state of affairs the treatise covers the epistemological foundations, abstract proto-mechanics, i. e. the theories of time and space, meta-mechanics, i. e. the theories of state space models and of quantities proper, and, as an instance of the latter, abstract elementary mechanics, the theory of translational motions of 'small' solid bodies in three-dimensional Euclidean space, including classical general relativity. Subsequently the theory of classical kinematics is developed as basis for interpreted proto-mechanics and interpreted elementary mechanics. As an amus

**Space Technology and Applications
International Forum - 1998** - S. El-Genk 1998

A set of three casebound volumes, discussing space technology and applications.

*The Future of Theoretical Physics and
Cosmology* - Stephen Hawking 60th Birthday

Workshop and Symposium (2002, Cambridge, England) 2003-10-23

Based on lectures given in honour of Stephen Hawking's sixtieth birthday, this book comprises contributions from some of the world's leading theoretical physicists. It begins with a section containing chapters by successful scientific popularisers, bringing to life both Hawking's work and other exciting developments in physics. The book then goes on to provide a critical evaluation of advanced subjects in modern cosmology and theoretical physics. Topics covered include the origin of the universe, warped spacetime, cosmological singularities, quantum gravity, black holes, string theory, quantum cosmology and inflation. As well as providing a fascinating overview of the wide variety of subject areas to which Stephen Hawking has contributed, this book represents an important assessment of prospects for the future of fundamental physics and cosmology.

Wormholes Explained - Richard Gaughan
2018-07-15

A wormhole is a tube-like distortion of time and space connecting distant places in the universe. Wormholes have been featured in many movies, but can they really exist? Wormholes are a prediction of scientific theories, and the precision of mathematics allows them to be described, even before they have ever been seen. Untangling complex physics theories with accessible language and captivating imagery, this book explores the development and evaluation of scientific theories behind wormholes. Supporting the Next Generation Science Standards' emphasis on scientific collection and analysis of data and evidence-based theories, this book will help students grasp the importance of mathematical models of reality, laying the groundwork for a deeper understanding of the nature of science. [Quantum Field Theory Under the Influence of External Conditions \(QFEXT09\)](#) -

The Eleventh Marcel Grossmann Meeting -

The Eleventh Marcel Grossmann Meeting - Hagen Kleinert 2008

The Marcel Grossmann Meetings are three-yearly forums that meet to discuss recent advances in gravitation, general relativity and relativistic field theories, emphasizing their mathematical foundations, physical predictions and experimental tests. These meetings aim to facilitate the exchange of ideas among scientists, to deepen our understanding of space-time structures, and to review the status of ongoing experiments and observations testing Einstein's theory of gravitation either from ground or space-based experiments. Since the first meeting in 1975 in Trieste, Italy, which was established by Remo Ruffini and Abdus Salam, the range of topics presented at these meetings has gradually widened to accommodate issues of major scientific interest, and attendance has grown to attract more than 900 participants

from over 80 countries. This proceedings volume of the eleventh meeting in the series, held in Berlin in 2006, highlights and records the developments and applications of Einstein's theory in diverse areas ranging from fundamental field theories to particle physics, astrophysics and cosmology, made possible by unprecedented technological developments in experimental and observational techniques from space, ground and underground observatories. It provides a broad sampling of the current work in the field, especially relativistic astrophysics, including many reviews by leading figures in the research community.

The Kalam Cosmological Argument, Volume 2 - Paul Copan 2017-11-16

The ancient kalam cosmological argument maintains that the series of past events is finite and that therefore the universe began to exist. Two recent scientific discoveries have yielded plausible prima facie physical evidence for the beginning of the universe. The expansion of the

universe points to its beginning-to a Big Bang-as one retraces the universe's expansion in time. And the second law of thermodynamics, which implies that the universe's energy is progressively degrading, suggests that the universe began with an initial low entropy condition. The kalam cosmological argument- perhaps the most discussed philosophical argument for God's existence in recent decades- maintains that whatever begins to exist must have a cause. And since the universe began to exist, there must be a transcendent cause of its beginning, a conclusion which is confirmatory of theism. So this medieval argument for the finitude of the past has received fresh wind in its sails from recent scientific discoveries. This collection reviews and assesses the merits of the latest scientific evidences for the universe's beginning. It ends with the kalam argument's conclusion that the universe has a cause- a personal cause with properties of theological significance.

Contemporary Natural Philosophy and Philosophies - Part 1 - Gordana Dodig-Crnkovic
2019-06-11

Modern information communication technology eradicates barriers of geographic distances, making the world globally interdependent, but this spatial globalization has not eliminated cultural fragmentation. The Two Cultures of C.P. Snow (that of science-technology and that of humanities) are drifting apart even faster than before, and they themselves crumble into increasingly specialized domains. Disintegrated knowledge has become subservient to the competition in technological and economic race leading in the direction chosen not by the reason, intellect, and shared value-based judgement, but rather by the whims of autocratic leaders or fashion controlled by marketers for the purposes of political or economic dominance. If we want to restore the authority of our best available knowledge and democratic values in guiding humanity, first we

have to reintegrate scattered domains of human knowledge and values and offer an evolving and diverse vision of common reality unified by sound methodology. This collection of articles responds to the call from the journal *Philosophies* to build a new, networked world of knowledge with domain specialists from different disciplines interacting and connecting with other knowledge-and-values-producing and knowledge-and-values-consuming communities in an inclusive, extended, contemporary natural-philosophic manner. In this process of synthesis, scientific and philosophical investigations enrich each other—with sciences informing philosophies about the best current knowledge of the world, both natural and human-made—while philosophies scrutinize the ontological, epistemological, and methodological foundations of sciences, providing scientists with questions and conceptual analyses. This is all directed at extending and deepening our existing comprehension of the world, including

ourselves, both as humans and as societies, and humankind.

Superradiance - Richard Brito 2015-07-10

This volume gives a unified picture of the multifaceted subject of superradiance, with a focus on recent developments in the field, ranging from fundamental physics to astrophysics. Superradiance is a radiation enhancement process that involves dissipative systems. With a 60 year-old history, superradiance has played a prominent role in optics, quantum mechanics and especially in relativity and astrophysics. In Einstein's General Relativity, black-hole superradiance is permitted by dissipation at the event horizon, which allows energy extraction from the vacuum, even at the classical level. When confined, this amplified radiation can give rise to strong instabilities known as "blackhole bombs", which have applications in searches for dark matter, in physics beyond the Standard Model and in analog models of gravity. This book discusses

and draws together all these fascinating aspects of superradiance.

How to Build a Time Machine - Paul Davies
2003-03-25

With his unique knack for making cutting-edge theoretical science effortlessly accessible, world-renowned physicist Paul Davies now tackles an issue that has boggled minds for centuries: Is time travel possible? The answer, insists Davies, is definitely yes—once you iron out a few kinks in the space-time continuum. With tongue placed firmly in cheek, Davies explains the theoretical physics that make visiting the future and revisiting the past possible, then proceeds to lay out a four-stage process for assembling a time machine and making it work. Wildly inventive and theoretically sound, *How to Build a Time Machine* is creative science at its best—illuminating, entertaining, and thought provoking.

Centering the Margins of Anthropology's History - Regna Darnell 2021-05

Centering the Margins of Anthropology's History circles around the conscious recognition of margins and suggests it is time to bring the margins to the center, both in terms of a changing theoretical openness and a supporting body of scholarship.

Advanced Concepts in Particle and Field Theory - Tristan Hübsch 2015-06-11

Uniting the usually distinct areas of particle physics and quantum field theory, gravity and general relativity, this expansive and comprehensive textbook of fundamental and theoretical physics describes the quest to consolidate the basic building blocks of nature, by journeying through contemporary discoveries in the field, and analysing elementary particles and their interactions. Designed for advanced undergraduates and graduate students and abounding in worked examples and detailed derivations, as well as including historical anecdotes and philosophical and methodological perspectives, this textbook provides students

with a unified understanding of all matter at the fundamental level. Topics range from gauge principles, particle decay and scattering cross-sections, the Higgs mechanism and mass generation, to spacetime geometries and supersymmetry. By combining historically separate areas of study and presenting them in a logically consistent manner, students will appreciate the underlying similarities and conceptual connections to be made in these fields.

Space Technology and Applications International Forum - 2000

Quantum Mechanics of Fundamental Systems: The Quest for Beauty and Simplicity - Marc Henneaux 2009-04-20

This article is dedicated to Claudio Bunster on the occasion of his 60th birthday. It is a great honor to take this opportunity to express my gratitude to him, who in my opinion has been the greatest national physicist ever, for his wise

guidance and intrepid support through the years. As a Chilean, I can further tell that Claudio's contributions have been well far beyond theoretical physics, helping our country to be ready to face future challenges through science. Gravity in diverse dimensions is a subject in which Claudio has done major contributions, encouraging in many ways the following work, that is being made along different fronts in collaboration with my colleagues Diego Correa, Gustavo Dotti, Julio Oliva and David Tempo.

The pursuit for wormhole solutions, which are handled in the spacetime topology, it is as old as General Relativity and it has appeared in theoretical physics within different subjects, ranging from the attempt of describing physics as pure geometry, as in the Einstein-Rosen bridge model of a particle [1], to the concept of "charge without charge" [2], as well as in different issues concerning the Euclidean approach to quantum gravity (see,

e.g., [3]). More recently, the systematic study of this kind of objects was pushed forward by the works of Morris, Thorne and Yurtsever [4,5]. *Black Holes, Cosmology And Extra Dimensions (Second Edition)* - Kirill A Bronnikov 2021-06-29 Assuming basic knowledge of special and general relativity, this book guides the reader to problems under consideration in modern research, concerning black holes, wormholes, cosmology, and extra dimensions. Its first part is devoted to local strong field configurations (black holes and wormholes) in general relativity and its most relevant extensions: scalar-tensor, $f(R)$, and multidimensional theories. The second part discusses cosmology, including inflation and problems of a unified description of the whole evolution of the universe. The third part concerns multidimensional theories of gravity and contains a number of original results obtained by the authors. Expository work is conducted for a mechanism of symmetries and fundamental constants formation. The original

approach to nonlinear multidimensional gravity that is able to construct a unique perspective describing different phenomena is highlighted. Much of the content was previously presented only in journal publications and is new for book contents, e.g., on regular black holes, various scalar field solutions, wormholes and their stability, inflation, clusters of primordial black holes, and multidimensional gravity. The last two topics are added in this new edition of the book. The other chapters are also updated to include new discoveries like the detection of gravitational waves.

Wormholes, Warp Drives and Energy Conditions - Francisco S. N. Lobo 2017-05-16

Top researchers in the field of gravitation present the state-of-the-art topics outlined in this book, ranging from the stability of rotating wormholes solutions supported by ghost scalar fields, modified gravity applied to wormholes, the study of novel semi-classical and nonlinear energy conditions, to the applications of

quantum effects and the superluminal version of the warp drive in modified spacetime. Based on Einstein's field equations, this cutting-edge research area explores the more far-fetched theoretical outcomes of General Relativity and relates them to quantum field theory. This includes quantum energy inequalities, flux energy conditions, and wormhole curvature, and sheds light on not just the theoretical physics but also on the possible applications to warp drives and time travel. This book extensively explores the physical properties and characteristics of these 'exotic spacetimes,' describing in detail the general relativistic geometries that generate closed timelike curves.

Lorentzian Wormholes - Matt Visser 1995
Drawing on pivotal work by Einstein, Wheeler, Thorne, Hawking, and others, Matt Visser charts the development and current state of Lorentzian wormhole physics. Dr. Visser shows that by pushing established physical theories to their limits, it is possible to deduce the true physics of

such exotica as wormholes and time travel. The physical framework he uses is derived from one of the major research frontiers of modern theoretical physics: quantum gravity the intersection of classical Einstein gravity and quantum field theory. About the Author Matt Visser is Research Assistant Professor at Washington University, St. Louis. He has lectured in the United States and abroad on topics including wormhole physics, time travel, and the chronology protection conjecture. He has conducted postdoctoral research at both the University of Southern California and at Los Alamos National Laboratory.

Lorentzian Wormholes - Matt Visser 1996-08-09
From H.G. Wells to Star Trek, audiences have been captivated by the notions of time travel, time warps, space warps, and wormholes. But science fiction is not the only realm where these concepts thrive. An active group of general relativists and quantum field theorists has produced a considerable body of serious

(thought admittedly speculative) mathematical and physical analyses of the wormhole system. Now, with this fascinating book, readers can explore in depth the science behind the science fiction. Drawing on pivotal work by Einstein, Wheeler, Morris, Thorne, Hawking, and others, Matt Visser charts the development and current state of Lorentzian wormhole physics. Dr. Visser shows that by pushing established physical theories to their limits, it is possible to deduce the physical properties of such exotica as wormholes and time travel. The physical framework he uses is derived from one of the major research frontiers of modern theoretical physics: quantum gravity-the intersection of classical Einstein gravity and quantum field theory. Physicists, students of general relativity, cosmology, quantum physics, or any interested reader with a background in physics will find this a provocative introduction to an exciting and active topic of ongoing research.

100 Years Of Relativity: Space-time

Structure - Einstein And Beyond - Abhay Ashtekar 2005-11-22

Thanks to Einstein's relativity theories, our notions of space and time underwent profound revisions about a 100 years ago. The resulting interplay between geometry and physics has dominated all of fundamental physics since then. This volume contains contributions from leading researchers, worldwide, who have thought deeply about the nature and consequences of this interplay. The articles take a long-range view of the subject and distill the most important advances in broad terms, making them easily accessible to non-specialists. The first part is devoted to a summary of how relativity theories were born (J Stachel). The second part discusses the most dramatic ramifications of general relativity, such as black holes (P Chrusciel and R Price), space-time singularities (H Nicolai and A Rendall), gravitational waves (P Laguna and P Saulson), the large scale structure of the cosmos (T Padmanabhan); experimental status of this

theory (C Will) as well as its practical application to the GPS system (N Ashby). The last part looks beyond Einstein and provides glimpses into what is in store for us in the 21st century.

Contributions here include summaries of radical changes in the notions of space and time that are emerging from quantum field theory in curved space-times (Ford), string theory (T Banks), loop quantum gravity (A Ashtekar), quantum cosmology (M Bojowald), discrete approaches (Dowker, Gambini and Pullin) and twistor theory (R Penrose).

[The General Theory of Relativity](#) - Anadijiban Das 2012-06-26

The General Theory of Relativity: A Mathematical Exposition will serve readers as a modern mathematical introduction to the general theory of relativity. Throughout the book, examples, worked-out problems, and exercises (with hints and solutions) are furnished. Topics in this book include, but are not limited to: tensor analysis the special theory

of relativity the general theory of relativity and Einstein's field equations spherically symmetric solutions and experimental confirmations static and stationary space-time domains black holes cosmological models algebraic classifications and the Newman-Penrose equations the coupled Einstein-Maxwell-Klein-Gordon equations appendices covering mathematical supplements and special topics Mathematical rigor, yet very clear presentation of the topics make this book a unique text for both university students and research scholars. Anadijiban Das has taught courses on Relativity Theory at The University College of Dublin, Ireland, Jadavpur University, India, Carnegie-Mellon University, USA, and Simon Fraser University, Canada. His major areas of research include, among diverse topics, the mathematical aspects of general relativity theory. Andrew DeBenedictis has taught courses in Theoretical Physics at Simon Fraser University, Canada, and is also a member of The Pacific Institute for the Mathematical Sciences.

His research interests include quantum gravity, classical gravity, and semi-classical gravity. *Eighth Marcel Grossmann Meeting, The: On Recent Developments In Theoretical And Experimental General Relativity, Gravitation, And Relativistic Field Theories - Proceedings Of The Meeting (In 2 Parts)* - Piran Tsvi 1999-05-14 Since 1975, the Marcel Grossmann Meetings have been organized to provide opportunities for discussing recent advances in gravitation, general relativity and relativistic field theories, emphasizing mathematical foundations, physical predictions and experimental tests. The objective of these meetings is to facilitate exchange among scientists that may deepen our understanding of space-time structures and to review the status of ongoing experiments aimed at testing Einstein's theory of gravitation from either the ground or space. The Eighth Marcel Grossmann Meeting took place on 22-27 June, 1997, at the Hebrew University of Jerusalem, Israel. The scientific program included 25

plenary talks and 40 parallel sessions during which 400 papers were presented. The papers that appear in this book cover all aspects of gravitation, from mathematical issues to recent observations and experiments.

Making Starships and Stargates - James F. Woodward 2012-12-15

To create the exotic materials and technologies needed to make stargates and warp drives is the holy grail of advanced propulsion. A less ambitious, but nonetheless revolutionary, goal is finding a way to accelerate a spaceship without having to lug along a gargantuan reservoir of fuel that you blow out a tailpipe. Tethers and solar sails are conventional realizations of the basic idea. There may now be a way to achieve these lofty objectives. "Making Starships and Stargates" will have three parts. The first will deal with information about the theories of relativity needed to understand the predictions of the effects that make possible the "propulsion" techniques, and an explanation of

those techniques. The second will deal with experimental investigations into the feasibility of the predicted effects; that is, do the effects exist and can they be applied to propulsion? The third part of the book - the most speculative - will examine the question: what physics is needed if we are to make wormholes and warp drives? Is

such physics plausible? And how might we go about actually building such devices? This book pulls all of that material together from various sources, updates and revises it, and presents it in a coherent form so that those interested will be able to find everything of relevance all in one place.