General Relativity An Einstein Centenary Survey

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General Relativity and Gravitation, 1989
Albert Einstein, Historical and Cultural Perspectives

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Einstein's Pathway to the Special Theory of Relativity Springer
In early April 1911 Albert Einstein arrived in Prague to become full professor of theoretical physics at the German part of Charles University. It was there, for the first time, that he concentrated primarily on the problem of gravitation. Before he left Prague in July 1912 he had submitted the paper “Relativität und Gravitation: Erwiderung auf eine Bemerkung von M. Abraham” in which he remarkably anticipated what a future theory of gravity should look like. At the occasion of the Einstein-in-Prague centenary an international meeting was organized under a title inspired by Einstein's last paper from the Prague period: "Relativity and Gravitation, 100 Years after Einstein in Prague". The main topics of the conference included: classical relativity, numerical relativity, relativistic astrophysics and cosmology, quantum gravity, experimental aspects of gravitation and conceptual and historical issues. The conference attracted over 200 scientists from 31 countries, among them a number of leading experts in the field of general relativity and its applications. This volume includes abstracts of the plenary talks and full texts of contributed talks and articles based on the posters presented at the conference. These describe primarily original results of the authors. Full texts of the plenary talks are included in the volume "General Relativity, Cosmology and Astrophysics--Perspectives 100 Years after Einstein in Prague", eds. J. Bičák and T. Ledvinka, published also by Springer Verlag.
The Large Scale Structure of Space-Time Cambridge University Press
It has been over 100 years since the presentation of the Theory of General Relativity by Albert Einstein, in its final formulation, to the Royal Prussian Academy of Sciences. To celebrate 100 years of general relativity, World Scientific publishes this volume with a dual goal: to assess the current status of the field of general relativity in broad terms, and discuss future directions. The volume thus consists of broad overviews summarizing major developments over the past decades and their perspective contributions.
The Perfect Theory World Scientific
In 1915, Albert Einstein unveiled his masterwork – a theory, in his words, 'of incomparable beauty': the General Theory of Relativity. It is sometimes overshadowed – wrongly, argues John Gribbin – by his work of 1905, the Special Theory of Relativity and E = mc≤. Just over 100 years later, the first direct detection of gravitational radiation is seen as the ultimate proof of the General Theory's accuracy. The General Theory describes the evolution of the Universe, black holes, the behaviour of orbiting neutron stars, and why clocks run slower on Earth than in space. It even suggests the possibility of time travel. In this 'beautifully written and highly accessible account of the genesis of a great theory' (Physics World), Gribbin vividly illustrates what an incomparable scientist Albert Einstein really was.
General Relativity University of Chicago Press
This volume contains the proceedings of the twelfth triannual International Conference on General Relativity and Gravitation, the premier conference for presentation and discussion of new ideas in relativity and cosmology. The volume will contain the invited talks as well as short reports on the parallel workshops that took place at the meeting. It will be essential reading for all research workers in relativity, cosmology and astrophysics.
An Einstein Encyclopedia World Scientific
Einstein's General Theory of Relativity leads to two remarkable predictions: first, that the ultimate destiny of many massive stars is to undergo gravitational collapse and to disappear from view, leaving behind a 'black hole' in space; and secondly, that there will exist singularities in space-time itself. These singularities are places where space-time begins or ends, and the presently known laws of physics break down. They will occur inside black holes, and in the past are what might be construed as the beginning of the universe. To show how these predictions arise, the authors discuss the General Theory of Relativity in the large. Starting with a precise formulation of the theory and an account of the necessary background of differential geometry, the significance of space-time curvature is discussed and the global properties of a number of exact solutions of Einstein's field equations are examined. The theory of the causal structure of a general space-time is developed, and is used to study black holes and to prove a number of theorems establishing the inevitability of singularities under certain conditions. A discussion of the Cauchy problem for General Relativity is also included in this 1973 book.
Einstein's Universe Princeton University Press
This book deals with 2-spinors in general relativity, beginning by developing spinors in a geometrical way rather than using representation theory, which can be a little abstract. This gives the reader greater physical intuition into the way in which spinors behave. The book concentrates on the algebra and calculus of spinors connected with curved space-time. Many of the well-known tensor fields in general relativity are shown to have spinor counterparts. An analysis of the Lanczos spinor concludes the book, and some of the techniques so far encountered are applied to this. Exercises play an important role throughout and are given at the end of each chapter.
Einstein 1905 Cambridge Scholars Publishing
The Tenth International Conference on General Relativity and Gravitation (GR10) was held from July 3 to July 8, 1983, in Padova, Italy. These Conferences take place every three years, under the auspices of the International Society on General Relativity and Gravitation, with the purpose of assessing the current research in the field, critically discussing the prog ress made and disclosing the points of paramount im portance which deserve further investigations. The Conference was attended by about 750 scientists active in the various subfields in which the current research on gravitation and general relativity is ar ticulated, and more than 450 communications were sub mitted. In order to fully exploit this great occur rence of experience and creative capacity, and to pro mote individual contributions to the collective know ledge, the Conference was given a structure of work shops on the most active topics and of general sessions in which the Conference was

addressed by invited speakers on general reviews or recent major advance ments of the field. The individual communications were collected in a two-volume publication made available to the participants upon their arrival and widely distributed to Scientific Institutions and Research Centres.
The Road to Relativity Gramercy
For Albert Einstein, 1905 was a remarkable year. It was also a miraculous year for the history and future of science. In six short months, from March through September of that year, Einstein published five papers that would transform our understanding of nature. This unparalleled period is the subject of John Rigden's book, which deftly explains what distinguishes 1905 from all other years in the annals of science, and elevates Einstein above all other scientists of the twentieth century. Rigden chronicles the momentous theories that Einstein put forth beginning in March 1905: his particle theory of light, rejected for decades but now a staple of physics; his overlooked dissertation on molecular dimensions; his theory of Brownian motion; his theory of special relativity; and the work in which his famous equation, E = mc2, first appeared. Through his lucid exposition of these ideas, the context in which they were presented, and the impact they had--and still have--on society, Rigden makes the circumstances of Einstein's greatness thoroughly and captivatingly clear. To help readers understand how these ideas continued to develop, he briefly describes Einstein's post-1905 contributions, including the general theory of relativity. One hundred years after Einstein's prodigious accomplishment, this book invites us to learn about ideas that have influenced our lives in almost inconceivable ways, and to appreciate their author's status as the standard of greatness in twentieth-century science.
The Cambridge Companion to Einstein Simon and Schuster
This book pieces together the jigsaw puzzle of Einstein’s journey to discovering the special theory of relativity. Between 1902 and 1905, Einstein sat in the Patent Office and may have made calculations on old pieces of paper that were once patent drafts. One can imagine Einstein trying to hide from his boss, writing notes on small sheets of paper, and, according to reports, seeing to it that the small sheets of paper on which he was writing would vanish into his desk-drawer as soon as he heard footsteps approaching his door. He probably discarded many pieces of papers and calculations and flung them in the waste paper basket in the Patent Office. The end result was that Einstein published nothing regarding the special theory of relativity prior to 1905. For many years before 1905, he had been intensely concerned with the topic; in fact, he was busily working on the problem for seven or eight years prior to 1905. Unfortunately, there are no surviving notebooks and manuscripts, no notes and papers or other primary sources from this critical period to provide any information about the crucial steps that led Einstein to his great discovery. In May 1905, Henri Poincaré sent three letters to Hendrik Lorentz at the same time that Einstein wrote his famous May 1905 letter to Conrad Habicht, promising him four works, of which the fourth one, Relativity, was a rough draft at that point. In the May 1905 letters to Lorentz, Poincaré presented the basic equations of his 1905 “Dynamics of the Electron”, meaning that, at this point, Poincaré and Einstein both had drafts of papers relating to the principle of relativity. The book discusses Einstein’s and Poincaré’s creativity and the process by which their ideas developed. The book also explores the misunderstandings and paradoxes apparent in the theory of relativity, and unravels the subtleties and creativity of Einstein.
A Relativist's Toolkit Cambridge University Press
This book introduces the general theory of relativity and includes applications to cosmology. The book provides a thorough introduction to tensor calculus and curved manifolds. After the necessary mathematical tools are introduced, the authors offer a thorough presentation of the theory of relativity. Also included are some advanced topics not previously covered by textbooks, including Kaluza-Klein theory, Israel's formalism and branes. Anisotropic cosmological models are also included. The book contains a large number of new exercises and examples, each with separate headings. The reader will benefit from an updated introduction to general relativity including the most recent developments in cosmology.
Einstein's Masterwork PublicAffairs
This brilliantly written book unlocks the astounding implications of Einstein's revolutionary theories on the nature of science, time and motion. It far surpasses any previous explanation of Relativity for laymen.
Centennial Of General Relativity: A Celebration Frontiers Media SA
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 = mc2. 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.
Traveling at the Speed of Thought World Scientific
This 2004 textbook fills a gap in the literature on general relativity by providing the advanced student with practical tools for the computation of many physically interesting quantities. The context is provided by the mathematical theory of black holes, one of the most elegant, successful, and relevant applications of general relativity. Among the topics discussed are congruencies of timelike and null geodesics, the embedding of spacelike, timelike and null hypersurfaces in spacetime, and the Lagrangian and Hamiltonian formulations of general relativity. Although the book is self-contained, it is not meant to serve as an introduction to general relativity. Instead, it is meant to help the reader acquire advanced skills and become a competent researcher in relativity and gravitational physics. The primary readership consists of graduate students in gravitational physics. It will also be a useful reference for more seasoned researchers working in this field.
Einstein's Greatest Mistake Princeton University Press
"A fascinating and thought-provoking story, one that sheds light on the origins of . . . the current challenging situation in physics." -- Wall Street Journal When the fuzzy indeterminacy of quantum mechanics overthrew the orderly world of Isaac Newton, Albert Einstein and Erwin Schröger were at the forefront of the revolution. Neither man was ever satisfied with the standard interpretation of quantum mechanics, however, and both rebelled against what they considered the most preposterous aspect of quantum mechanics: its randomness. Einstein famously quipped that God does not play dice with the universe, and Schröger constructed his famous fable of a cat that was

neither alive nor dead not to explain quantum mechanics but to highlight the apparent absurdity of a theory gone wrong. But these two giants did more than just criticize: they fought back, seeking a Theory of Everything that would make the universe seem sensible again. In Einstein's Dice and Schröger's Cat, physicist Paul Halpern tells the little-known story of how Einstein and Schröger searched, first as collaborators and then as competitors, for a theory that transcended quantum weirdness. This story of their quest-which ultimately failed-provides readers with new insights into the history of physics and the lives and work of two scientists whose obsessions drove its progress. Today, much of modern physics remains focused on the search for a Theory of Everything. As Halpern explains, the recent discovery of the Higgs Boson makes the Standard Model-the closest thing we have to a unified theory- nearly complete. And while Einstein and Schröger failed in their attempt to explain everything in the cosmos through pure geometry, the development of string theory has, in its own quantum way, brought this idea back into vogue. As in so many things, even when they were wrong, Einstein and Schröger couldn't help but get a great deal right.

Einstein's General Theory of Relativity Basic Books

"Stanley is a storyteller par excellence."--The Washington Post Kirkus Review starred review; Publishers Weekly starred review; Booklist starred review The birth of a world-changing idea in the middle of a bloodbath Einstein's War is a riveting exploration of both the beauty of scientific creativity and enduring horrors of human nature. These two great forces battle in a story that culminates with a victory now a century old, the mind-bending theory of general relativity. Few recognize how the Great War, the industrialized slaughter that bled Europe from 1914 to 1918, shaped Einstein's life and work. While Einstein never held a rifle, he formulated general relativity blockaded in Berlin, literally starving. He lost fifty pounds in three months, unable to communicate with his most important colleagues. Some of those colleagues fought against rabid nationalism; others were busy inventing chemical warfare--being a scientist trapped you in the power plays of empire. Meanwhile, Einstein struggled to craft relativity and persuade the world that it was correct. This was, after all, the first complete revision of our conception of the universe since Isaac Newton, and its victory was far from sure. Scientists seeking to confirm Einstein's ideas were arrested as spies. Technical journals were banned as enemy propaganda. Colleagues died in the trenches. Einstein was separated from his most crucial ally by barbed wire and U-boats. This ally was the Quaker astronomer and Cambridge don A. S. Eddington, who would go on to convince the world of the truth of relativity and the greatness of Einstein. In May of 1919, when Europe was still in chaos from the war, Eddington led a globe-spanning expedition to catch a fleeting solar eclipse for a rare opportunity to confirm Einstein's bold prediction that light has weight. It was the result of this expedition--the proof of relativity, as many saw it--that put Einstein on front pages around the world. Matthew Stanley's epic tale is a celebration of how bigotry and nationalism can be defeated and of what science can offer when they are.

Relativity and Gravitation Springer

Explore spectacular advances in contemporary physics with this unique celebration of the centennial of Einstein's discovery of general relativity.

Was Einstein Right? Princeton University Press

Divided into three parts, this volume focuses on a summary of how relativity theories were born. It also discusses the ramifications of general relativity, such as black holes, space-time singularities, gravitational waves, the large scale structure of the cosmos, and more. It includes summaries of radical changes in the notions of space and time.

Einstein's Miraculous Year Cambridge University Press

Writing for the general reader or student, Wald has completely revised and updated this highly regarded work to include recent developments in black hole physics and cosmology. Nature called the first edition "a very readable and accurate account of modern relativity physics for the layman within the unavoidable constraint of almost no mathematics. . . . A well written, entertaining and authoritative book."

Introduction To 2-spinors In General Relativity Springer Science & Business Media

A thrilling adventure story chronicling the perilous journey of the scientists who set out to prove the theory of relativity--the results of which catapulted Albert Einstein to fame and forever changed our understanding of the universe. In 1911, a relatively unknown physicist named Albert Einstein published his preliminary theory of gravity. But it hadn't been tested. To do that, he needed a photograph of starlight as it passed the sun during a total solar eclipse. So began a nearly decade-long quest by seven determined astronomers from observatories in four countries, who traveled the world during five eclipses to capture the elusive sight. Over the years, they faced thunderstorms, the ravages of a world war, lost equipment, and local superstitions. Finally, in May of 1919, British expeditions to northern Brazil and the island of Príncipe managed to photograph the stars, confirming Einstein's theory. At its heart, this is a story of frustration, faith, and ultimate victory--and of the scientists whose efforts helped build the framework for the big bang theory, catapulted Einstein to international fame, and shook the foundation of physics.

General Relativity and Gravitation Basic Books

The articles included in this Volume represent a broad and highly qualified view on the present state of general relativity, quantum gravity, and their cosmological and astrophysical implications. As such, it may serve as a valuable source of knowledge and inspiration for experts in these fields, as well as an advanced source of information for young researchers. The occasion to gather together so many leading experts in the field was to celebrate the centenary of Einstein's stay in Prague in 1911-1912. It was in fact during his stay in Prague that Einstein started in earnest to develop his ideas about general relativity that fully developed in his paper in 1915. Approaching soon the centenary of his famous paper, this volume offers a precious overview of the path done by the scientific community in this intriguing and vibrant field in the last century, defining the challenges of the next 100 years. The content is divided into four broad parts: (i) Gravity and Prague, (ii) Classical General Relativity, (iii) Cosmology and Quantum Gravity, and (iv) Numerical Relativity and Relativistic Astrophysics.