The Future Of Spacetime

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A Collection of Polish Works on Philosophical Problems of Time and Spacetime
A Journey Through Spacetime

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The Future of Humanity Courier Corporation

This book gives a rigourous discussion of the local effects of curvature on the behaviour of waves. In the course of this discussion many techniques are developed which are also needed for a study of more general problems, in which the gravitational field itself plays a dynamical role.

Space-Time Algebra Elsevier

From two of the world's great physicists—Stephen Hawking and Nobel laureate Roger Penrose—a lively debate about the nature of space and time Einstein said that the most incomprehensible thing about the universe is that it is comprehensible. But was he right? Can the quantum theory of fields and Einstein's general theory of relativity, the two most accurate and successful theories in all of physics, be united into a single quantum theory of gravity? Can quantum and cosmos ever be combined? In The Nature of Space and Time, two of the world’s most famous physicists—Stephen Hawking (A Brief History of Time) and Roger Penrose (The Road to Reality)—debate these questions. The authors outline how their positions have further diverged on a number of key issues, including the spatial geometry of the universe, inflationary versus cyclic theories of the cosmos, and the black-hole information-loss paradox. Though much progress has been made, Hawking and Penrose stress that physicists still have further to go in their quest for a quantum theory of gravity.

The Far-future Universe Springer-Verlag

Not only the general public, but even students of physics appear to believe that the physics concept of spacetime was introduced by Einstein. This is both unfortunate and unfair. It was Hermann Minkowski (Einstein's mathematics professor) who announced the new four-dimensional (spacetime) view of the world in 1908, which he deduced from experimental physics by decoding the profound message hidden in the failed experiments designed to discover absolute motion. Minkowski realized that the images coming from our senses, which seem to represent an evolving three-dimensional world, are only glimpses of a higher four-dimensional reality that is not divided into past, present, and future since space and all moments of time form an inseparable entity (spacetime). Einstein's initial reaction to Minkowski's view of spacetime and the associated with it four-dimensional physics (also introduced by Minkowski) was not quite favorable: "Since the mathematicians have invaded the relativity theory, I do not understand it myself any more."

However, later Einstein adopted not only Minkowski's spacetime physics (which was crucial for Einstein's revolutionary theory of gravity as curvature of spacetime), but also Minkowski's world view as evident from Einstein's letter of condolences to the widow of his longtime friend Besso: "Now Besso has departed from this strange world a little ahead of me. That means nothing. People like us, who believe in physics, know that the distinction between past, present and future is only a stubbornly persistent illusion." Besso left this world on 15 March 1955; Einstein followed him on 18 April 1955. This volume contains Hermann Minkowski's four works, which laid the foundations of spacetime physics: Space and Time, The Relativity Principle, The Fundamental Equations for Electromagnetic Processes in Moving Bodies and A Derivation of the Fundamental Equations for the Electromagnetic Processes in Moving Bodies from the Standpoint of the Theory of Electrons. These papers have never been published together either in German or English and the second and the last paper have not been translated into English so far.

Geometrical Physics in Minkowski Spacetime Rowohlt Verlag GmbH

This is the story of Richard, a normal person, and his distant descendant from the future, Matt! They travel through time to ancient Greece and have many adventures there. In the end, Matt says goodbye to Richard and has an uncertain future in his time and requests Richard to prevent Global Warming to help improve the Earth's climate.

Reflections on Spacetime Princeton University Press

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 singualarities under certain conditions. A discussion of the Cauchy problem for General Relativity is also included in this 1973 book.

Die Physik des Bewusstseins Cambridge University Press

One of the most of exciting aspects is the general relativity pred- tion of black holes and the Such Big Bang. predictions gained weight the theorems through Penrose. singularity pioneered In various by te- books on theorems general relativity singularity are and then presented used to that black holes exist and that the argue universe started with a To date what has big been is bang. a critical of what lacking analysis these theorems predict-’ We of really give a proof a typical singul- theorem and this ity use theorem to illustrate problems arising through the of possibilities violations" and "causality weak "shell very crossing These singularities". add to the problems weight of view that the point theorems alone singularity are not sufficient to the existence of predict physical singularities. The mathematical theme of the book In order to both solid gain a of and intuition understanding good for any mathematical theory, one,should to realise it as model of try a a fam- iar non-mathematical theories have had concept. Physical an especially the important on of and impact development mathematics, conversely various modern theories physical rather require sophisticated mathem- ics for their formulation. both and mathematics Today, physics are so that it is often difficult complex to master the theories in both very s- in the of jects. However, case differential pseudo-Riemannian geometry or the general relativity between and mathematics relationship physics is and it is therefore especially close, to from interd- possible profit an ciplinary approach.

The Large Scale Structure of Space-Time Simon and Schuster

Accompanying DVD-ROM contains the electronic proceedings of the summer school on mathematical general relativity and global properties of solutions of Einstein's equations held at Cargèse, Corsica, France, July 20-Aug. 10, 2002.
Space, Time and Number in the Brain Rowohlt Verlag GmbH
Where the science of black holes, gravitational waves, and time travel will likely lead us, as reported by spacetime's most important theoreticians and observers.
Symmetrie Cambridge University Press
Contrary to the conventional wisdom held by many in much of human history, in this book Peter Baofu here proposes what he calls «the perspectival theory of space-time.» According to this theory, there are multiple perspectives of space and time in society, culture, the mind, and nature, all of which are subject to «the regression-progression principle» in «existential dialectics.» These perspectives exist in society, culture, the mind, and nature with good reasons, being subject to «the symmetry-asymmetry principle» in «existential dialectics» and with some being more successful and hegemonic (dominant) than others. Furthermore and more importantly in the long haul, space and time as humans have known them will end and will eventually be altered by post-humans in different forms, be they here in this universe or in multiverses, subject to «the change-constancy principle» in «existential dialectics.»
2001: A Spacetime Odyssey Springer

Science & Business Media
A spacetime appetizer -- Relatively speaking -- Einstein on trial -- Wave talk and bar fights -- The lives of stars -- Clockwork precision -- Laser quest -- The path to perfection -- Creation stories -- Cold case -- Gotcha -- Black magic -- Nanoscience -- Follow-up questions -- Space invaders -- Surf's up for Einstein wave astronomy
Time Reborn Springer
A theoretical physicist and author of the controversial best-seller The Trouble with Physics describes his new approach for thinking about the reality of time and explains his theory about the laws of physics not being timeless but rather capable of evolving.
Minkowski Spacetime: A Hundred Years Later W. W. Norton & Company
This book offers a presentation of the special theory of relativity that is mathematically rigorous and yet spells out in considerable detail the physical significance of the mathematics. It treats, in addition to the usual menu of topics one is accustomed to finding in introductions to special relativity, a wide variety of results of more contemporary origin. These include Zeeman’s characterization of the causal automorphisms of Minkowski spacetime, the Penrose theorem on the apparent shape of a relativistically moving sphere, a detailed introduction to the theory of spinors, a Petrov-type classification of electromagnetic fields in both tensor and spinor form, a topology for Minkowski spacetime whose homeomorphism group is essentially the Lorentz group, and a

careful discussion of Dirac’s famous Scissors Problem and its relation to the notion of a two-valued representation of the Lorentz group. This second edition includes a new chapter on the de Sitter universe which is intended to serve two purposes. The first is to provide a gentle prologue to the steps one must take to move beyond special relativity and adapt to the presence of gravitational fields that cannot be considered negligible. The second is to understand some of the basic features of a model of the empty universe that differs markedly from Minkowski spacetime, but may be recommended by recent astronomical observations suggesting that the expansion of our own universe is accelerating rather than slowing down. The treatment presumes only a knowledge of linear algebra in the first three chapters, a bit of real analysis in the fourth and, in two appendices, some elementary point-set topology. The first edition of the book received the 1993 CHOICE award for Outstanding Academic Title. Reviews of first edition: “... a valuable contribution to the pedagogical literature which will be enjoyed by all who delight in precise mathematics and physics.” (American Mathematical Society, 1993) “Where many physics texts explain physical phenomena by means of mathematical models, here a rigorous and detailed mathematical development is accompanied by precise physical interpretations.” (CHOICE, 1993) “... his talent in choosing the most significant results and ordering them within the book can’t be denied. The reading of the book is, really, a pleasure.” (Dutch Mathematical Society, 1993)

Spacetime Cambridge University Press Theoretical physics and foundations of physics have not made much progress in the last few decades. Whether we are talking about unifying general relativity and quantum field theory (quantum gravity), explaining so-called dark energy and dark matter (cosmology), or the interpretation and implications of quantum mechanics and relativity, there is no consensus in sight. In addition, both enterprises are deeply puzzled about various facets of time including above all, time as experienced. The authors argue that, across the board, this impasse is the result of the "dynamical universe paradigm," the idea that reality is fundamentally made up of physical entities that evolve in time from some initial state according to dynamical laws. Thus, in the dynamical universe, the initial conditions plus the dynamical laws explain everything else going exclusively forward in time. In cosmology, for example, the initial conditions reside in the Big Bang and the dynamical law is supplied by general relativity. Accordingly, the present state of the universe is explained exclusively by its past. This book offers a completely new paradigm (called Relational Blockworld), whereby the past, present and future co-determine each other via "adynamical global constraints," such as the least action principle. Accordingly, the future is just as important for explaining the present as is the past.

Most of the book is devoted to showing how Relational Blockworld resolves many of the current conundrums of both theoretical physics and foundations of physics, including the mystery of time as experienced and how that experience relates to the block universe.
Space, Time, Matter Springer Science & Business Media
A SUNDAY TIMES BOOK OF THE YEAR Human civilization is on the verge of spreading beyond Earth. More than a possibility, it is becoming a necessity: whether our hand is forced by climate change and resource depletion or whether future catastrophes compel us to abandon Earth, one day we will make our homes among the stars. World-renowned physicist and futurist Michio Kaku explores in rich, accessible detail how humanity might gradually develop a sustainable civilization in outer space. With his trademark storytelling verve, Kaku shows us how science fiction is becoming reality: mind-boggling developments in robotics, nanotechnology, and biotechnology could enable us to build habitable cities on Mars; nearby stars might be reached by microscopic spaceships sailing through space on laser beams; and technology might one day allow us to transcend our physical bodies entirely. With irrepressible enthusiasm and wonder, Dr. Kaku takes readers on a fascinating journey to a future in which humanity could finally fulfil its long-awaited destiny among the stars - and perhaps even achieve immortality.
Relativity and the Nature of Spacetime

Birkhäuser
On 14 September 2015, after 50 years of searching, gravitational waves were detected for the first time and astronomy changed for ever. Until then, investigation of the universe had depended on electromagnetic radiation: visible light, radio, X-rays and the rest. But gravitational waves – ripples in the fabric of space and time – are unrelenting, passing through barriers that stop light dead. At the two 4-kilometre long LIGO observatories in the US, scientists developed incredibly sensitive detectors, capable of spotting a movement 100 times smaller than the nucleus of an atom. In 2015 they spotted the ripples produced by two black holes spiralling into each other, setting spacetime quivering. This was the first time black holes had ever been directly detected – and it promises far more for the future of astronomy. Brian Clegg presents a compelling story of human technical endeavour and a new, powerful path to understand the workings of the universe.

From Eternity to Here Houghton Mifflin Harcourt
Twenty years after Stephen Hawking's 9-million-copy selling A Brief History of Time, pioneering theoretical physicist Sean Carroll takes our investigation into the nature of time to the next level. You can't unscramble an egg and you can't remember the future. But what if time doesn't (or didn't!) always go in the same direction? Carroll's paradigm-shifting research suggests that other universes experience time running in the

opposite direction to our own. Exploring subjects from entropy and quantum mechanics to time travel and the meaning of life, Carroll presents a dazzling new view of how we came to exist.
WordsBrew
From the reviews: "This attractive book provides an account of the theory of special relativity from a geometrical viewpoint, explaining the unification and insights that are given by such a treatment. [...] Can be read with profit by all who have taken a first course in relativity physics." ASLIB Book Guide
The Future of Theoretical Physics and Cosmology Springer Science & Business Media
The different possible singularities are defined and the mathematical methods needed to extend the space-time are described in detail in this book. Results obtained (many appearing here for the first time) show that singularities are associated with a lack of smoothness in the Riemann tensor.
The Geometry of Minkowski Spacetime Cambridge University Press
"The standard treatise on the general theory of relativity." — Nature "Whatever the future may bring, Professor Weyl's book will remain a classic of physics." — British Journal for Philosophy and Science Reflecting the revolution in scientific and philosophic thought which accompanied the Einstein relativity theories, Dr. Weyl has probed deeply into the notions of space, time, and matter. A rigorous examination of the state of our knowledge of the world

following these developments is undertaken with this guiding principle: that although further scientific thought may take us far beyond our present conception of the world, we may never again return to the previous narrow and restricted scheme. Although a degree of mathematical sophistication is presupposed, Dr. Weyl develops all the tensor calculus necessary to his exposition. He then proceeds to an analysis of the concept of Euclidean space and the spatial conceptions of Riemann. From this the nature of the amalgamation of space and time is derived. This leads to an exposition and examination of Einstein's general theory of relativity and the concomitant theory of gravitation. A detailed investigation follows devoted to gravitational waves, a rigorous solution of the problem of one body, laws of conservation, and the energy of gravitation. Dr. Weyl's introduction of the concept of tensor-density as a magnitude of quantity (contrasted with tensors which are considered to be magnitudes of intensity) is a major step toward a clearer understanding of the relationships among space, time, and matter.

The Wave Equation on a Curved Space-Time The Future of Spacetime Celebrating the one hundredth anniversary of the 1909 publication of Minkowski’s seminal paper "Space and Time", this volume includes a fresh translation as well as the original in German, and a number of contributed papers on the still-controversial subject.

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