

Bernard H Lavenda

A NEW PERSPECTIVE ON RELATIVITY

An Odyssey in Non-Euclidean Geometries



World Scientific

A New Perspective On Relativity An Odyssey In Non Euclidean Geometries

David E. Rowe, Tilman Sauer, Scott A. Walter

A New Perspective On Relativity An Odyssey In Non Euclidean Geometries:

A New Perspective on Relativity Bernard H. Lavenda, 2012 Starting off from noneuclidean geometries apart from the method of Einstein's equations this book derives and describes the phenomena of gravitation and diffraction. A historical account is presented exposing the missing link in Einstein's construction of the theory of general relativity the uniformly rotating disc together with his failure to realize that the Beltrami metric of hyperbolic geometry with constant curvature describes exactly the uniform acceleration observed. This book also explores these questions: How does time bend? Why should gravity propagate at the speed of light? How does the expansion function of the universe relate to the absolute constant of the noneuclidean geometries? Why was the Sagnac effect ignored? Can Maxwell's equations accommodate mass? Is there an inertia due solely to polarization? Can objects expand in elliptic geometry like they contract in hyperbolic geometry?

Gravitational Optics in Curved Spacetimes: Contrasting Newtonian and Relativistic Perspectives Bernard Lavenda, 2025-05-26 This book offers a critical appraisal of where we stand on a formulation of a theory of gravitation. Newtonian theory is reformulated in the general form of conics and their relation to aberrancy. Conics are to planetary orbits what Cassini ovals are to binaries. The transition from a Bernoulli lemniscate to Cassini ovals is discussed in terms the instability criteria of Roche lobes and their fission. When the second derivative of the curve is no longer constant the Newton inverse law does not apply and new central forces appear which can be derived from the radius of aberrancy just as the inverse square law follows from the radius of curvature. The logarithmic spiral becomes periodic in velocity space and a new Hubble law appears between acceleration and velocity. This has the effect of decreasing the decay rate of accelerations so that they can explain the flat rotational curvatures observed in spiral galaxies. Numerical relativity has reduced its conception of general relativity to a Le Sage type theory thereby making it refutable.

Where Physics Went Wrong

Bernard H. Lavenda, 2015-02-02 The book points out what has gone wrong with physics since Einstein's formulation of this theory of general relativity a century ago. It points out inconsistencies and fallacies in the standard model of the big bang and the inflationary scenario which was supposed to have overcome those shortcomings the evolution of string theory from a theory of the strong interaction to a theory of gravitation and quantum mechanics which has not produced a single verifiable prediction and what it has accomplished is reaffirming wrong results like the entropy of a black hole which is not an entropy at all. There have even been attempts to demote gravity to an emergent phenomenon with catastrophic effects. We know exactly what happened at 10³⁴ seconds after the big bang but do not know how fast gravity propagates whether gravitational waves exist and what are the limits of Newton's law. Attempts to rectify this are the prediction of dark energy matter which has never been observed nor ever will and MOND. The latter is really not a modification of Newtonian mechanics but a transformation of a dynamical law into a statistical one.

The Concept of Time in Early Twentieth-Century Philosophy Flavia Santioanni, 2015-11-26 This book presents a collection of authoritative contributions

on the concept of time in early twentieth century philosophy It is structured in the form of a thematic atlas each section is accompanied by relevant elementary logic maps that reproduce in a spatial form the directionalities arguments and or discourses reported on in the text The book is divided into three main sections the first of which covers phenomenology and the perception of time by analyzing the works of Bergson Husserl Sartre Merleau Ponty Deleuze Guattari and Derrida The second section focuses on the language and conceptualization of time examining the works of Cassirer Wittgenstein Heidegger Lacan Ricoeur and Foucault while the last section addresses the science and logic of time as they appear in the works of Guillaume Einstein Reichenbach Prigogine and Barbour The purpose of the book is threefold to provide readers with a comprehensive overview of the concept of time in early twentieth century philosophy to show how conceptual reasoning can be supported by accompanying linguistic and spatial representations and to stimulate novel research in the humanistic field concerning the complex role of graphic representations in the comprehension of concepts

Scale Transitions As Foundations Of Physics Ioan Merches, Maricel Agop, Nicolae Mazilu, 2021-02-04 The scale transitions are essential to physical knowledge The book describes the history of essential moments of physics viewed as necessary consequences of the unavoidable process of scale transition and provides the mathematical techniques for the construction of a theoretical physics founded on scale transition The indispensable mathematical technique is analyticity helping in the construction of space coordinate systems The indispensable theoretical technique from physical point of view is the affine theory of surfaces The connection between the two techniques is provided by a duality in defining the physical properties

A Mathematical Journey to Relativity Vladimir-Georges Boskoff, Salvatore Capozziello, 2021-06-02 This book opens with an axiomatic description of Euclidean and non Euclidean geometries Euclidean geometry is the starting point to understand all other geometries and it is the cornerstone for our basic intuition of vector spaces The generalization to non Euclidean geometry is the following step to develop the language of Special and General Relativity These theories are discussed starting from a full geometric point of view Differential geometry is presented in the simplest way and it is applied to describe the physical world The final result of this construction is deriving the Einstein field equations for gravitation and spacetime dynamics Possible solutions and their physical implications are also discussed the Schwarzschild metric the relativistic trajectory of planets the deflection of light the black holes the cosmological solutions like de Sitter Friedmann Lemaître Robertson Walker and Gödel ones Some current problems like dark energy are also sketched The book is self contained and includes details of all proofs It provides solutions or tips to solve problems and exercises It is designed for undergraduate students and for all readers who want a first geometric approach to Special and General Relativity

Understanding Einstein's Theories of Relativity Stan Glibisco, 1983 Einstein's theory is presented in a simplified manner Upper level high school students who are technically inclined should find it interesting and within their grasp

What Einstein Did Not See Thomas W. Sills, 2009 Today physics sees time and space as two words that seem to defy definition One unique definition for each of these words will not

help to describe the complex nature of time and space. Further definitions for time and space require more than seeing how they interrelate with each other. One uses different mathematical geometries to describe space. Understanding these different geometries provides a better approach to defining both time and space. In the seventeenth century Euclidean geometry limited Isaac Newton to a three dimensional space. Two parallel lines will never merge epitomizes Euclidean geometry. In the nineteenth century new geometry evolved. Sometimes called non Euclidean or Riemann geometry this new geometry applies to space with more than three dimensions. Einstein used this geometry in his theory of general relativity. Two parallel lines will merge epitomizes non Euclidean geometry. This book presents a new approach to both time and space. For the first time readers will see how Euclidean geometry can describe space with more than three dimensions. This new approach redefines time into two different components a vector of Timespace and a scalar of Universal Time. Amazing insights result from this new approach. Three dimensional projections from four dimensional Euclidean space can now visually illustrate time travel. Contraction of Timespace the fourth physical dimension becomes equivalent to Einstein's time dilation. General knowledge of Euclidean geometry allows the reader to understand the complex nature of higher dimensions in a new way. Readers enjoy a friendly informative walk into four and higher dimensions of space. New ideas in this book revise conventional physics. These ideas transform the three dimensional world of conventional physics into a four dimensional physical world. Relativity and Geometry Roberto Torretti, 1996-01-01. Early in this century it was shown that the new non Newtonian physics known as Einstein's Special Theory of Relativity rested on a new non Euclidean geometry which incorporated time and space into a unified chronogeometric structure. This high level study elucidates the motivation and significance of the changes in physical geometry brought about by Einstein in both the first and the second phase of Relativity. After a discussion of Newtonian principles and 19th century views on electrodynamics and the aether the author offers illuminating expositions of Einstein's electrodynamics of moving bodies. Minkowski spacetime Einstein's quest for a theory of gravity gravitational geometry the concept of simultaneity time and causality and other topics. An important Appendix designed to define spacetime curvature considers differentiable manifolds fiber bundles linear connections and useful formulae. Relativity continues to be a major focus of interest for physicists mathematicians and philosophers of science. This highly regarded work offers them a rich historico critical exposition emphasizing geometrical ideas of the elements of the Special and General Theory of Relativity.

Relativity and Common Sense Hermann Bondi, 1964-01-01. This radically reoriented and popular presentation of Einstein's Special Theory of Relativity derives its concepts from Newtonian ideas rather than by opposing them. It demonstrates that time is relative rather than absolute that high speeds affect the nature of time and that acceleration affects speed time and mass. Very little mathematics is required and 60 illustrations augment the text. **Beyond Einstein** David E. Rowe, Tilman Sauer, Scott A. Walter, 2018-06-18. Beyond Einstein Perspectives on Geometry Gravitation and Cosmology explores the rich interplay between mathematical and physical ideas by studying the interactions of major actors and the roles of important

research communities over the course of the last century

Space from Zeno to Einstein Nick Huggett, 1999-04-01

Learning through original texts can be a powerful heuristic tool. This book collects a dozen classic readings that are generally accepted as the most significant contributions to the philosophy of space. The readings have been selected both on the basis of their relevance to recent debates on the nature of space and on the extent to which they carry premonitions of

contemporary physics. In his detailed commentaries Nick Huggett weaves together the readings and links them to our modern understanding of the subject. Together the readings indicate the general historical development of the concept of space and in his commentaries Huggett explains their logical relations. He also uses our contemporary understanding of space to help clarify the key ideas of the texts. One goal is to prepare the reader both scientist and nonscientist to learn and understand relativity theory, the basis of our current understanding of space. The readings are by Zeno, Plato, Aristotle, Euclid, Descartes, Newton, Leibniz, Clarke, Berkeley, Kant, Mach, Poincaré, and Einstein.

The Relativity of All Things Laurent Nottale, 2019-03-28. Translated into English for the first time this brilliant French bestseller by eminent astrophysicist Laurent Nottale presents the theory of scale relativity which offers a framework for the unification of quantum theory and relativity through fractal geometry. Updated and revised with a new afterword by philosopher of science Charles Alunni. *The Relativity of All Things* is the first of Nottale's popularly accessible works available to English language readers. To describe the ideas of relativity and quantum mechanics without a single mathematical formula is a veritable feat of magic. With a philosophical audacity that only non philosophers can possess Nottale finds that the essence of the principle of relativity is in fact the affirmation of the existence of universal laws applied at every scale. His task is enormous. He proposes that the theory of relativity and that of quantum mechanics with the radical schism between their findings and methods of thinking can be reconciled. Nottale's methodological innovation is truly revolutionary. To bring it to fruition he weds the mathematics of fractals with the theory of relativity. Nottale's approach shows us that we are far from the end of science we are perhaps only at its recommencement. Basarab Nicolescu, Business Digest Einstein himself explicitly considered that a realistic approach to the quantum problem could go through the introduction of non differentiability in physics. In 1948 he wrote in a letter to Wolfgang Pauli: Maybe someone will find out another possibility provided he searches with enough perseverance. Laurent Nottale is very precisely this someone. Read and study this wonderful theory let yourself be carried away by its beauty, its depth and its major experimental implications which are nothing less than fundamental for the future of science and for philosophy. Charles Alunni, Director Laboratoire Disciplinaire Pensée des Sciences at the cole Normale Supérieure. Since the birth of quantum theory physicists have been challenged with the development of a unified theory of quantum mechanics and relativity with no general consensus on the best way forward. To progress further we have to confront deep questions about space and time quantum theory and cosmology which take theory back into contact with experiment. The theory of scale relativity offers a serious contribution to the debate on unification offering an intuitive insight into how these theories could

be fundamentally linked through space time geometry Philip Turner Director Centre for Plant Science and Biopolymer Research Edinburgh Napier University Laurent Nottale proposes that we look at the concept of fractals to make relativity extended further yet the fundamental principle on which to base quantum mechanics After the relativity of time and space he has tackled the relativity of scale putting into question much of what we thought we knew Pierre Bonnaure

FuturiblesDevelopments in geometry have often enabled progress in physics especially when concerning relativity Non Euclidean geometry geometrical systems where the plane is a sphere made it possible for Einstein to devise his theory of curved space Today a new geometry fractal geometry allows us to propose a theory of fractal space Id es cl s by Business Digest

Einstein's Relativity And Beyond: New Symmetry Approaches Hsin-i Chang,Jong-ping Hsu,2000-07-20 The purposes of this book are 1 to explore and expound relativity physics and four dimensional symmetry from the logically simplest viewpoint by making one single postulate instead of two and 2 to indicate the simplest generalization of the Lorentz transformation in order to cope with frames with constant linear accelerations The fundamentally new ideas of the first purpose are developed on the basis of the term paper of a Harvard physics undergraduate They lead to an unexpected affirmative answer to the long standing question of whether it is possible to construct a relativity theory without postulating the constancy of the speed of light and retaining only the first postulate of special relativity This question was discussed in the early years following the discovery of special relativity by many physicists including Ritz Tolman Kunz Comstock and Pauli all of whom obtained negative answers Furthermore the new theory of relativity indicates the truly universal and fundamental constants in physics and provides a broad view of relativistic physics beyond special relativity It substantiates the view and sheds light on the understanding that the four dimensional symmetry framework can accommodate many different concepts of physical time including common time and Reichenbach s general concept of time This logically simplest viewpoint of relativity allows a natural extension of the physics of particles and fields from inertial frames to noninertial frames in which the speed of light is not constant New predictions in physics resulting from this new viewpoint are discussed

The book is based on papers by the author and his collaborators in Physics Letters A Nuovo Cimento B and Physical Review A and D The Theory of Relativity and its Influence on Scientific Thought Arthur Eddington,2018-04-12 Every one now admits that the Ptolemaic system which regarded the earth as the centre of all things belongs to the dark ages But to our dismay we have discovered that the same geocentric outlook still permeates modern physics through and through

unsuspected until recently It has been left to Einstein to carry forward the revolution begun by Copernicus to free our conception of nature from the terrestrial bias imported into it by the limitations of our earthbound experience To achieve a more neutral point of view we have to imagine a visit to some other heavenly body That is a theme which has attracted the popular novelist and we often smile at his mistakes when sooner or later he forgets where he is supposed to be and endows his voyagers with some purely terrestrial appanage impossible on the star they are visiting But scientific men who have not

the novelist's licence have made the same blunder

The Einstein Theory of Relativity Lillian Rosanoff Lieber, 2008 A clear and vivid exposition of the essential ideas and methods of the theory of relativity can be warmly recommended especially to those who cannot spend too much time on the subject Albert Einstein Using just enough mathematics to help and not to hinder the lay reader Lillian Lieber provides a thorough explanation of Einstein's theory of relativity Her delightful style in combination with her husband's charming illustrations makes for an interesting and accessible read about one of the greatest ideas of all times

Analytic Hyperbolic Geometry and Albert Einstein's Special Theory of Relativity Abraham A. Ungar, 2008 This book presents a powerful way to study Einstein's special theory of relativity and its underlying hyperbolic geometry in which analogies with classical results form the right tool It introduces the notion of vectors into analytic hyperbolic geometry where they are called gyrovector Newtonian velocity addition is the common vector addition which is both commutative and associative The resulting vector spaces in turn form the algebraic setting for the standard model of Euclidean geometry In full analogy Einsteinian velocity addition is a gyrovector addition which is both gyrocommutative and gyroassociative The resulting gyrovector spaces in turn form the algebraic setting for the Beltrami Klein ball model of the hyperbolic geometry of Bolyai and Lobachevsky Similarly MAbius addition gives rise to gyrovector spaces that form the algebraic setting for the Poincar r ball model of hyperbolic geometry In full analogy with classical results the book presents a novel relativistic interpretation of stellar aberration in terms of relativistic gyrotrigonometry and gyrovector addition Furthermore the book presents for the first time the relativistic center of mass of an isolated system of noninteracting particles that coincided at some initial time $t = 0$ The novel relativistic resultant mass of the system concentrated at the relativistic center of mass dictates the validity of the dark matter and the dark energy that were introduced by cosmologists as ad hoc postulates to explain cosmological observations about missing gravitational force and late time cosmic accelerated expansion The discovery of the relativistic center of mass in this book thus demonstrates once again the usefulness of the study of Einstein's special theory of relativity in terms of its underlying analytic hyperbolic geometry Sample Chapter s Chapter 1 Introduction 145 KB Contents Gyrogroups Gyrocommutative Gyrogroups Gyrogroup Extension Gyrovector and Cogyrovector Gyrovector Spaces Rudiments of Differential Geometry Gyrotrigonometry Bloch Gyrovector of Quantum Information and Computation Special Theory of Relativity The Analytic Hyperbolic Geometric Viewpoint Relativistic Gyrotrigonometry Stellar and Particle Aberration Readership Undergraduates graduate students researchers and academics in geometry algebra mathematical physics theoretical physics and astronomy

The Geometry of Special Relativity Tevian Dray, 2021-06-10 This unique book presents a particularly beautiful way of looking at special relativity The author encourages students to see beyond the formulas to the deeper structure The unification of space and time introduced by Einstein's special theory of relativity is one of the cornerstones of the modern scientific description of the universe Yet the unification is counterintuitive because we perceive time very differently from space Even in relativity time is not just another

dimension it is one with different properties The book treats the geometry of hyperbolas as the key to understanding special relativity The author simplifies the formulas and emphasizes their geometric content Many important relations including the famous relativistic addition formula for velocities then follow directly from the appropriate hyperbolic trigonometric addition formulas Prior mastery of ordinary trigonometry is sufficient for most of the material presented although occasional use is made of elementary differential calculus and the chapter on electromagnetism assumes some more advanced knowledge Changes to the Second Edition The treatment of Minkowski space and spacetime diagrams has been expanded Several new topics have been added including a geometric derivation of Lorentz transformations a discussion of three dimensional spacetime diagrams and a brief geometric description of area and how it can be used to measure time and distance Minor notational changes were made to avoid conflict with existing usage in the literature Table of Contents Preface 1 Introduction 2 The Physics of Special Relativity 3 Circle Geometry 4 Hyperbola Geometry 5 The Geometry of Special Relativity 6 Applications 7 Problems III 8 Paradoxes 9 Relativistic Mechanics 10 Problems II 11 Relativistic Electromagnetism 12 Problems III 13 Beyond Special Relativity 14 Three Dimensional Spacetime Diagrams 15 Minkowski Area via Light Boxes 16 Hyperbolic Geometry 17 Calculus Bibliography Author Biography Tevian Dray is a Professor of Mathematics at Oregon State University His research lies at the interface between mathematics and physics involving differential geometry and general relativity as well as nonassociative algebra and particle physics he also studies student understanding of middle division mathematics and physics content Educated at MIT and Berkeley he held postdoctoral positions in both mathematics and physics in several countries prior to coming to OSU in 1988 Professor Dray is a Fellow of the American Physical Society for his work in relativity and an award winning teacher [Physical Relativity](#) Harvey R. Brown, 2005-11-24 *Physical Relativity* explores the nature of the distinction at the heart of Einstein's 1905 formulation of his special theory of relativity that between kinematics and dynamics Einstein himself became increasingly uncomfortable with this distinction and with the limitations of what he called the principle theory approach inspired by the logic of thermodynamics A handful of physicists and philosophers have over the last century likewise expressed doubts about Einstein's treatment of the relativistic behaviour of rigid bodies and clocks in motion in the kinematical part of his great paper and suggested that the dynamical understanding of length contraction and time dilation intimated by the immediate precursors of Einstein is more fundamental Harvey Brown both examines and extends these arguments which support a more constructive approach to relativistic effects in Einstein's terminology after giving a careful analysis of key features of the pre history of relativity theory He argues furthermore that the geometrization of the theory by Minkowski in 1908 brought illumination but not a causal explanation of relativistic effects Finally Brown tries to show that the dynamical interpretation of special relativity defended in the book is consistent with the role this theory must play as a limiting case of Einstein's 1915 theory of gravity the general theory of relativity Appearing in the centennial year of Einstein's celebrated paper on special relativity *Physical Relativity* is an unusual

critical examination of the way Einstein formulated his theory It also examines in detail certain specific historical and conceptual issues that have long given rise to debate in both special and general relativity theory such as the conventionality of simultaneity the principle of general covariance and the consistency or otherwise of the special theory with quantum mechanics Harvey Brown s new interpretation of relativity theory will interest anyone working on these central topics in modern physics

Spacetime Geometry Of Relativity: Extending Pythagorean Theorem Takashi Kenjo, Shigeru Sano, 2025-03-05 The theory of relativity was created by Einstein in two stages extending over a decade from 1905 to 1915 General relativity is said to be the most powerful tool that can be used to explain the behavior of the universe In this book we try to comprehend the universe with a fundamental formula known as the Pythagorean theorem used as a vehicle to review the essence of Euclidean geometry and non Euclidean geometry then move on to Newtonian mechanics and review the historical development of electromagnetism setting the stage for special relativity Next we describe Einstein s efforts to generalize his theory to include gravitation which led to a geometric theory of spacetime the gravitational field equations The German astronomer Schwarzschild quickly solved these equations for a special case Also presented are the numerical graphical results of the planetary orbits and light trajectories using the Python code that we created Then the reader is taken on an excursion to the physics of the microcosm describing how special relativity was instrumental in the development of quantum theory and how several Japanese physicists contributed to atomic and particle physics Finally we end the book by introducing the work of Roger Penrose on black holes which is closely related to Schwarzschild s solution and the existence of intrinsic singularity at the center of black holes In his intriguing theory of Conformal Cyclic Cosmology our universe may be one in a never ending birth and death cycle of universes

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