

## How To Teach Relativity To Your Dog By Orzel Chad Author Paperback 2012

Writing a new book on the classic subject of Special Relativity, on which numerous important physicists have contributed and many books have already been written, can be like adding another epicycle to the Ptolemaic cosmology. Furthermore, it is our belief that if a book has no new elements, but simply repeats what is written in the existing literature, perhaps with a different style, then this is not enough to justify its publication. However, after having spent a number of years, both in class and research with relativity, I have come to the conclusion that there exists a place for a new book. Since it appears that somewhere along the way, mathematics may have obscured and prevailed to the degree that we tend to teach relativity (and I believe, theoretical physics) simply using “heavier” mathematics without the inspiration and the mastery of the classic physicists of the last century. Moreover current trends encourage the application of techniques in producing quick results and not tedious conceptual approaches resulting in long-lasting reasoning. On the other hand, physics cannot be done a la carte stripped from philosophy, or, to put it in a simple but dramatic context A building is not an accumulation of stones! As a result of the above, a major aim in the writing of this book has been the distinction between the mathematics of Minkowski space and the physics of relativity.

This companion volume to *My First Book of Quantum Physics* introduces complex science to children through bright illustrations and amusing text.

Megumi is an all-star athlete, but she's a failure when it comes to physics class. And she can't concentrate on her tennis matches when she's worried about the questions she missed on the big test! Luckily for her, she befriends Ryota, a patient physics geek who uses real-world examples to help her understand classical mechanics—and improve her tennis game in the process! In *The Manga Guide to Physics*, you'll follow alongside Megumi as she learns about the physics of everyday objects like roller skates, slingshots, braking cars, and tennis serves. In no time, you'll master tough concepts like momentum and impulse, parabolic motion, and the relationship between force, mass, and acceleration. You'll also learn how to: –Apply Newton's three laws of motion to real-life problems –Determine how objects will move after a collision –Draw vector diagrams and simplify complex problems using trigonometry –Calculate how an object's kinetic energy changes as its potential energy increases If you're mystified by the basics of physics or you just need a refresher, *The Manga Guide to Physics* will get you up to speed in a lively, quirky, and practical way. This compact yet informative Guide presents an accessible route through Special Relativity, taking a modern axiomatic and geometrical approach. It begins by explaining key concepts and introducing Einstein's postulates. The consequences of the postulates - length contraction and time dilation - are unravelled qualitatively and then quantitatively. These strands are then tied together using the mathematical framework of the Lorentz transformation, before applying these ideas to kinematics and dynamics. This volume demonstrates the essential simplicity of the core ideas of Special Relativity, while acknowledging the challenges of developing new intuitions and dealing with the apparent paradoxes that arise. A valuable supplementary resource for intermediate undergraduates, as well as independent learners with some technical background, the Guide includes numerous exercises with hints and notes provided online. It lays the foundations for further study in General Relativity, which is introduced briefly in an appendix.

A Brief History of Timekeeping

From Newton to Einstein

Unifying Block Universe Physics and Time as Experienced

The Manga Guide to Relativity

Special, General, and Cosmological

Science, Art, and Einstein's Relativity in Educational Reform

This comprehensive textbook on relativity integrates Newtonian physics, special relativity and general relativity into a single book that emphasizes the deep underlying principles common to them all, yet explains how they are applied in different ways in these three contexts. Newton's ideas about how to represent space and time, his laws of dynamics, and his theory of gravitation established the conceptual foundation from which modern physics developed. Book I in this volume offers undergraduates a modern view of Newtonian theory, emphasizing those aspects needed for understanding quantum and relativistic contemporary physics. In 1905, Albert Einstein proposed a novel representation of space and time, special relativity. Book II presents relativistic dynamics in inertial and accelerated frames, as well as a detailed overview of Maxwell's theory of electromagnetism. This provides undergraduate and graduate students with the background necessary for studying particle and accelerator physics, astrophysics and Einstein's theory of general relativity. In 1915, Einstein proposed a new theory of gravitation, general relativity. Book III in this volume develops the geometrical framework in which Einstein's equations are formulated, and presents several key applications: black holes, gravitational radiation, and cosmology, which will prepare graduate students to carry out research in relativistic astrophysics, gravitational wave astronomy, and cosmology.

Introduction to Relativity is intended to teach physics and astronomy majors at the freshman, sophomore or upper-division levels how to think about special and general relativity in a fundamental, but accessible, way. Designed to render any reader a "master of relativity", everything on the subject is comprehensible and derivable from first principles. The book emphasizes problem solving, contains abundant problem sets, and is conveniently organized to meet the needs of both student and instructor. Simplicity: the book teaches space and time in

relativity in a physical fashion with minimal mathematics  
Conciseness: the book teaches relativity by emphasizing the basic simplicity of the principles at work  
Visualization: space-time diagrams (Minkowski) illustrate phenomena from simultaneity to the resolution of the twin paradox in a concrete fashion  
Worked problems: two chapters of challenging problems solved in several ways illustrate and teach the principles  
Problem sets: each chapter is accompanied by a full set of problems for the student that teach the principles and some new phenomena

An astrophysicist offers an entertaining introduction to Einstein's theories, explaining how well they have held up to rigorous testing over the years, and even describing the amazing phenomena readers would actually experience if they took a trip through a black hole. Your alarm goes off, and you head to the kitchen to make yourself some toast and a cup of coffee. Little do you know, as you savor the aroma of the steam rising from your cup, that your ordinary morning routine depends on some of the weirdest phenomena ever discovered. The world of quantum physics is generally thought of as hopelessly esoteric. While classical physics gives us the laws governing why a ball rolls downhill, how a plane is able to fly, and so on, its quantum cousin gives us particles that are actually waves, "spooky" action at a distance, and Schrodinger's unlucky cat. But, believe it or not, even the most mundane of everyday activities is profoundly influenced by the abstract and exotic world of the quantum. In *Breakfast with Einstein*, Chad Orzel illuminates the strange phenomena lurking just beneath the surface of our ordinary lives by digging into the surprisingly complicated physics involved in his (and anyone's) morning routine. Orzel, author of *How to Teach Quantum Physics to Your Dog*, explores how quantum connects with everyday reality, and offers engaging, layperson-level explanations of the mind-bending ideas central to modern physics. From the sun, alarm clocks, and the red glow of a toaster's hot filaments (the glow that launched quantum mechanics) to the chemistry of food aroma, a typical day is rich with examples of quantum weirdness. *Breakfast with Einstein* reveals the hidden physics all around us, and after reading this book, your ordinary mornings will never seem quite as ordinary again.

General Relativity for Babies

The Theoretical Minimum

Introduction to Relativity

Reimagining Time

Teaching Einsteinian Physics in Schools

Problem Book in Relativity and Gravitation

In this, the second volume in an important new series presenting core concepts across a range of critical areas of human knowledge, author Joanne Baker unravels the complexities of 20th-century scientific theory for a general readership. From Hubble's law to the Pauli exclusion principle, and from Schrodinger's cat to Heisenberg's uncertainty principle, she explains ideas at the cutting-edge of scientific enquiry, making them comprehensible and accessible to the layperson.

Nonspecialists with no prior knowledge of physics and only reasonable proficiency with algebra can now understand Einstein's special theory of relativity. Effectively diagrammed and with an emphasis on logical structure, Leo Sartori's rigorous but simple presentation will guide interested readers through concepts of relative time and relative space. Sartori covers general relativity and cosmology, but focuses on Einstein's theory. He tracks its history and implications. He explores illuminating paradoxes, including the famous twin paradox, the "pole-in-the-barn" paradox, and the Loedel diagram, which is an accessible, graphic approach to relativity. Students of the history and philosophy of science will welcome this concise introduction to the central concept of modern physics.

Fans of Chris Ferrie's *ABCs of Science*, *Organic Chemistry for Babies*, and *Quantum Physics for Babies* will love this introduction to Einstein's most famous theory! Help your future genius become the smartest baby in the room! It only takes a small spark to ignite a child's mind. Written by an expert, *General Relativity for Babies* is a colorfully simple introduction to Einstein's most famous theory. Babies (and grownups!) will learn all about black holes, gravitational waves, and more. With a tongue-in-cheek approach that adults will love, this installment of the Baby University board book series is the perfect way to introduce basic concepts to even the youngest scientists. After all, it's never too early to become a quantum physicist! If you're looking for books similar to *Baby Loves Science* by Ruth Spiro, quantum information for babies, or infant science books, look no further! *General Relativity for Babies* offers fun early learning for your little quantum physicist!

Explains the principles of relativity, profiling leading minds such as Albert Einstein, Brian Greene, and Stephen Hawking to simplify their theories on time dilation, extra dimensions, and relative motion.

Understanding Relativity

Understanding Einstein's Relativity

A Student's Guide to Special Relativity

Modern Physics for Non-scientists

Relativity in Modern Physics

How to Teach Relativity to Your Dog

In *Relativity Demystified* a physicist explains Einstein's theory of relativity in layman's terms, minus heavy-duty discussion or formal mathematics. Author David McMahon gradually builds up readers' practical skills to a point where they can eventually solve real problems in the field of general relativity. The book offers examples that vary in complexity from textbook-like problems to real-world situations from actual current research. *Relativity Demystified* also focused on quick definitions and demonstrations of procedures needed to solve problems.

This book provides a thorough introduction to Einstein's special theory of relativity, suitable for anyone with a minimum of one year's university physics with calculus. It is divided into fundamental and advanced topics. The first section starts by recalling the Pythagorean rule and its relation to the geometry of space, then covers every aspect of special relativity, including the history. The second section covers the impact of relativity in quantum theory, with an introduction to relativistic quantum mechanics and quantum field theory. It also goes over the group theory of the Lorentz group, a simple introduction to supersymmetry, and ends with cutting-edge topics such as general relativity, the standard model of elementary particles and its extensions, superstring theory, and a survey of important unsolved problems. Each chapter comes with a set of exercises. The book is accompanied by a CD-ROM illustrating, through interactive animation, classic problems in relativity involving motion.

2022 NATIONAL INDIE EXCELLENCE AWARDS WINNER — HISTORY: GENERAL ". . . inherently interesting, unique, and highly recommended addition to personal, professional, community, college, and academic library Physics of Time & Scientific Measurement history collections, and supplemental curriculum studies lists. " —Midwest Book Review "A wonderful look into understanding and recording time, Orzel ' s latest is appropriate for all readers who are curious about those ticks and tocks that mark nearly every aspect of our lives." —Booklist " A thorough, enjoyable exploration of the history and science behind measuring time. " —Foreword Reviews It ' s all a matter of time—literally. From the movements of the spheres to the slipperiness of relativity, the story of science unfolds through the fascinating history of humanity ' s efforts to keep time. Our modern lives are ruled by clocks and watches, smartphone apps and calendar programs. While our gadgets may be new, however, the drive to measure and master time is anything but—and in A Brief History of Timekeeping, Chad Orzel traces the path from Stonehenge to your smartphone. Predating written language and marching on through human history, the desire for ever-better timekeeping has spurred technological innovation and sparked theories that radically reshaped our understanding of the universe and our place in it. Orzel, a physicist and the bestselling author of Breakfast with Einstein and How to Teach Quantum Physics to Your Dog continues his tradition of demystifying thorny scientific concepts by using the clocks and calendars central to our everyday activities as a jumping-off point to explore the science underlying the ways we keep track of our time. Ancient solstice markers (which still work perfectly 5,000 years later) depend on the basic astrophysics of our solar system; mechanical clocks owe their development to Newtonian physics; and the ultra-precise atomic timekeeping that enables GPS hinges on the predictable oddities of quantum mechanics. Along the way, Orzel visits the delicate negotiations involved in Gregorian calendar reform, the intricate and entirely unique system employed by the Maya, and how the problem of synchronizing clocks at different locations ultimately required us to abandon the idea of time as an absolute and universal quantity. Sharp and engaging, A Brief History of Timekeeping is a story not just about the science of sundials, sandglasses, and mechanical clocks, but also the politics of calendars and time zones, the philosophy of measurement, and the nature of space and time itself. For those interested in science, technology, or history, or anyone who ' s ever wondered about the instruments that divide our days into moments: the time you spend reading this book may fly, and it is certain to be well spent.

"Wald's book is clearly the first textbook on general relativity with a totally modern point of view; and it succeeds very well where others are only partially successful. The book includes full discussions of many problems of current interest which are not treated in any extant book, and all these matters are considered with perception and understanding."—S. Chandrasekhar "A tour de force: lucid, straightforward, mathematically rigorous, exacting in the analysis of the theory in its physical aspect."—L. P. Hughston, Times Higher Education Supplement "Truly excellent. . . . A sophisticated text of manageable size that will probably be read by every student of relativity, astrophysics, and field theory for years to come."—James W. York, Physics Today

A Simplified Approach to Einstein's Theories

Special Relativity, Electrodynamics, and General Relativity

A First Course in General Relativity

General Relativity

Breakfast with Einstein

Simply Einstein: Relativity Demystified

Presents a step-by-step explanation of Einstein's Special Theory of Relativity through a series of diagrams rather than equations.

With this reader-friendly book, it doesn't take an Einstein to understand the theory of relativity and its remarkable consequences. In clear, understandable terms, physicist Richard Wolfson explores the ideas at the heart of relativity and shows how they lead to such seeming absurdities as time travel, curved space, black holes, and new meaning for the idea of past and future. Drawing from years of teaching modern physics to nonscientists, Wolfson explains in a lively, conversational style the simple principles underlying Einstein's theory. Relativity, Wolfson shows, gave us a new view of space and time, opening the door to questions about their flexible nature: Is the universe finite or infinite? Will it expand forever or eventually collapse in a "big crunch"? Is time travel possible? What goes on inside a black hole? How does gravity really work? These questions at the forefront of twenty-first-century physics are all rooted in the profound and sweeping vision of Albert Einstein's early twentieth-century theory. Wolfson leads his readers on an intellectual journey that culminates in a universe made almost unimaginably rich by the principles that Einstein first discovered.

Second edition of a widely-used textbook providing the first step into general relativity for undergraduate students with minimal mathematical background.

An essential resource for learning about general relativity and much more, from four leading experts Important and useful to every student of relativity, this book is a unique collection of some 475 problems--with solutions--in the fields of special and general relativity, gravitation, relativistic astrophysics, and cosmology. The problems are expressed in broad physical terms to enhance their pertinence to readers with diverse backgrounds. In their solutions, the authors have attempted to convey a mode of approach to these kinds of problems, revealing procedures that can reduce the labor of calculations while avoiding the pitfall of too much or too powerful formalism. Although well suited for individual use, the volume may also be used with one of the modern textbooks in general relativity.

Relativity

An Introduction with 200 Problems and Solutions

An Intuitive Introduction to Einstein's Ideas, and Why They Matter

For Physicists and Astronomers  
50 Physics Ideas You Really Need to Know  
Galileo Unbound

This text brings the challenge and excitement of modern relativity and cosmology at rigorous mathematical level within reach of advanced undergraduates and beginning graduates.

Concise treatment, based on ideas of Einstein and Minkowski, geared toward advanced undergraduates and graduate students of physics. Topics include old physics, new geometry, special relativity, curved space, and general relativity. 1950 edition.

"Special Relativity is a superb text for students to begin or continue a serious study of physics. Describing the most accessible of the 20th-century revolutions, it also illustrates the fact that nature is stranger than one imagines. The book evolved through years of teaching a highly-successful course to thousands of first-year students in science and engineering. It is appropriate as part of an introductory physics course, as a supplement to a "modern physics" course, as a text for a special topics or advanced placement course, or even as a supplement in an advanced undergraduate course. Numerous illustrations, examples, and problems are presented throughout, with the concise mathematical description postponed until after the reader has built up some physical intuition for what is going on. The book contains many applications, from particle decays, colliding-beam experiments and photon rockets to a brief introduction to relativistic gravitation, including the Principle of Equivalence, the effect of altitude on clocks, and the Global Positioning System. Ten appendices can be taken up as interest and time allow, including The "Cosmic Speed Limit." The book is a serious introduction, praised for its clarity, accessibility, and informal, light-hearted style."--pub. desc.

In *It's About Time*, N. David Mermin asserts that relativity ought to be an important part of everyone's education--after all, it is largely about time, a subject with which all are familiar. The book reveals that some of our most intuitive notions about time are shockingly wrong, and that the real nature of time discovered by Einstein can be rigorously explained without advanced mathematics. This readable exposition of the nature of time as addressed in Einstein's theory of relativity is accessible to anyone who remembers a little high school algebra and elementary plane geometry. The book evolved as Mermin taught the subject to diverse groups of undergraduates at Cornell University, none of them science majors, over three and a half decades. Mermin's approach is imaginative, yet accurate and complete. Clear, lively, and informal, the book will appeal to intellectually curious readers of all kinds, including even professional physicists, who will be intrigued by its highly original approach.

What Is Relativity?

From Einstein to Strings

Productive Learning

A Path Across Life, the Universe and Everything

Special Relativity

Relativity Demystified

Presents the fundamental ideas of relativity and quantum physics.

This unique resource promotes the creation of productive learning contexts, which allow students to bring all that they are to the learning process, as essential to successful educational reform.

The third volume in the bestselling physics series cracks open Einstein's special relativity and field theory. Physicist Leonard Susskind and data engineer Art Friedman are back. This time, they introduce readers to Einstein's special relativity and Maxwell's classical field theory. Using their typical brand of real math, enlightening drawings, and humor, Susskind and Friedman walk us through the complexities of waves, forces, and particles by exploring special relativity and electromagnetism. It's a must-read for both devotees of the series and any armchair physicist who wants to improve their knowledge of physics' deepest truths.

Galileo Unbound traces the journey that brought us from Galileo's law of free fall to today's geneticists measuring evolutionary drift, entangled quantum particles moving among many worlds, and our lives as trajectories traversing a health space with thousands of dimensions. Remarkably, common themes persist that predict the evolution of species as readily as the orbits of planets or the collapse of stars into black holes. This book tells the history of spaces of expanding dimension and increasing abstraction and how they continue today to give new insight into the physics of complex systems. Galileo published the first modern law of motion, the Law of Fall, that was ideal and simple, laying the foundation upon which Newton built the first theory of dynamics. Early in the twentieth century, geometry became the cause of motion rather than the result when Einstein envisioned the fabric of space-time warped by mass and energy, forcing light rays to bend past the Sun. Possibly more radical was Feynman's dilemma of quantum particles taking all paths at once — setting the stage for the modern fields of quantum field theory and quantum computing. Yet as concepts of motion have evolved, one thing has remained constant, the need to track ever more complex changes and to capture their essence, to find patterns in the chaos as we try to predict and control our world.

A Light-Speed Tour of Einstein's Theory of Relativity

My First Book of Relativity

The Special Theory of Relativity

A Graphic Guide

Special Relativity and Classical Field Theory

Relativity for the Questioning Mind

They say you can't teach an old dog new tricks. But what about relativity? Physics professor Chad Orzel and his inquisitive canine companion, Emmy, tackle the concepts of general relativity in this irresistible introduction to Einstein's physics. Through armchair—and sometimes passenger-seat—conversations with Emmy about the relative speeds of dog and cat motion or the logistics of squirrel-chasing, Orzel translates complex Einsteinian ideas—the slowing of time for a moving observer, the shrinking of moving objects, the effects of gravity on light and time, black holes, the Big Bang, and of course,

$E=mc^2$ —into examples simple enough for a dog to understand. A lively romp through one of the great theories of modern physics, *How to Teach Relativity to Your Dog* will teach you everything you ever wanted to know about space, time, and anything else you might have slept through in high school physics class.

Original publication and copyright date: 2009.

Everything's gone screwy at Tagai Academy. When the headmaster forces Minagi's entire class to study Einstein's theory of relativity over summer school, Minagi volunteers to go in their place. There's just one problem: He's never even heard of relativity before! Luckily, Minagi has the plucky Miss Uruga to teach him. Follow along with *The Manga Guide to Relativity* as Minagi learns about the non-intuitive laws that shape our universe. Before you know it, you'll master difficult concepts like inertial frames of reference, unified spacetime, and the equivalence principle. You'll see how relativity affects modern astronomy and discover why GPS systems and other everyday technologies depend on Einstein's extraordinary discovery. *The Manga Guide to Relativity* also teaches you how to: –Understand and use  $E = mc^2$ , the world's most famous equation –Calculate the effects of time dilation using the Pythagorean theorem –Understand classic thought experiments like the Twin Paradox, and see why length contracts and mass increases at relativistic speeds –Grasp the underpinnings of Einstein's special and general theories of relativity If the idea of bending space and time really warps your brain, let *The Manga Guide to Relativity* straighten things out.

The book presents the theory of relativity as a unified whole. By showing that the concepts of this theory are interrelated to form a unified totality David Bohm supplements some of the more specialist courses which have tended to give students a fragmentary impression of the logical and conceptual nature of physics as a whole.

Ask the Physicist about Mechanics and Relativity

It's About Time

An Essential Guide for Teachers in Training and Practice

Mathematics of Relativity

Einstein's Relativity and the Quantum Revolution

The Exotic Physics of Everyday Objects

*Special Relativity, Electrodynamics, and General Relativity: From Newton to Einstein* is intended to teach students of physics, astrophysics, astronomy, and cosmology how to think about special and general relativity in a fundamental but accessible way. Designed to render any reader a "master of relativity, all material on the subject is comprehensible and derivable from first principles. The book emphasizes problem solving, contains abundant problem sets, and is conveniently organized to meet the needs of both student and instructor. Fully revised and expanded second edition with improved figures Enlarged discussion of dynamics and the relativistic version of Newton's second law Resolves the twin paradox from the principles of special and general relativity Includes new chapters which derive magnetism from relativity and electrostatics Derives Maxwell's equations from Gauss' law and the principles of special relativity Includes new chapters on differential geometry, space-time curvature, and the field equations of general relativity Introduces black holes and gravitational waves as illustrations of the principles of general relativity and relates them to the 2015 and 2017 observational discoveries of LIGO For anyone seeking a brief, clear overview of modern general relativity which emphasizes physics over mathematics, McGlinn's *Introduction to Relativity* is indispensable.

In our world today, scientists and technologists speak one language of reality. Everyone else, whether they be prime ministers, lawyers, or primary school teachers speak an outdated Newtonian language of reality. While Newton saw time and space as rigid and absolute, Einstein showed that time is relative – it depends on height and velocity – and that space can stretch and distort. The modern Einsteinian perspective represents a significant paradigm shift compared with the Newtonian paradigm that underpins most of the school education today. Research has shown that young learners quickly access and accept Einsteinian concepts and the modern language of reality. Students enjoy learning about curved space, photons, gravitational waves, and time dilation; often, they ask for more! A consistent education within the Einsteinian paradigm requires rethinking of science education across the entire school curriculum, and this is now attracting attention around the world. This book brings together a coherent set of chapters written by leading experts in the field of Einsteinian physics education. The book begins by exploring the fundamental concepts of space, time, light, and gravity and how teachers can introduce these topics at an early age. A radical change in the curriculum requires new learning instruments and innovative instructional approaches. Throughout the book, the authors emphasise and discuss evidence-based approaches to Einsteinian concepts, including computer- based tools, geometrical methods, models and analogies, and simplified mathematical treatments. *Teaching Einsteinian Physics in Schools* is designed as a resource for teacher education students, primary and secondary science teachers, and for anyone interested in a scientifically accurate description of physical reality at a level appropriate for school education.

A quirky, funny, and accessible blend of science and art that delves into the heart of Einstein's theory of relativity It was a link to his 1905 paper--an early attempt at explaining his revolutionary ideas on space, time, and matter--that drew Tanya Bub into Albert Einstein's imaginative vision of the world. What particularly struck her was how Einstein interwove words and math to create clear visuals illustrating his theories. As an artist, she naturally started doodling as she worked her way through his concepts, creating drawings that intuitively demonstrated Einstein's core principles. In *Reimagining Time* Tanya Bub teams up with her father, the distinguished physicist Jeffrey Bub, to create a quirky and accessible take on one of science's most revolutionary discoveries. Blending original art and text, they guide readers through Einstein's theory of special relativity to expose truths about our universe: time is relative, lengths get shorter with motion, energy and mass are interchangeable, and the Universe has a speed limit.

An Illustrated Guide to Relativity

Introducing Relativity

## The Manga Guide to Physics Beyond the Dynamical Universe How to Teach Physics to Your Dog

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.

The appendixes provide helpful hints, basic answers to the sample problems, and materials to stimulate further exploration.

A superlative, fascinating graphic account of Albert Einstein's strange world and how his legacy has been built upon since. It is now more than a century since Einstein's theories of Special and General Relativity began to revolutionise our view of the universe. Beginning near the speed of light and proceeding to explorations of space-time and curved spaces, *Introducing Relativity* plots a visually accessible course through the thought experiments that have given shape to contemporary physics. Scientists from Isaac Newton to Stephen Hawking add their unique contributions to this story, as we encounter Einstein's astounding vision of gravity as the curvature of space-time and arrive at the breathtakingly beautiful field equations. Einstein's legacy is reviewed in the most advanced frontiers of physics today - black holes, gravitational waves, the accelerating universe and string theory.

*From Newton to Einstein* is a book devoted to classical mechanics. "Classical" here includes the theory of special relativity as well because, as argued in the book, it is essentially Newtonian mechanics extended to very high speeds. This information is expanded from the author's popular Q&A website, a site aimed primarily at general readers who are curious about how physics explains the workings of the world. Hence, the answers emphasize concepts over formalism, and the mathematics is kept to a minimum. Students new to physics will find discussion and quantitative calculations for areas often neglected in introductory courses (e.g. air drag and non-inertial frames). The author gives us a more intuitive approach to special relativity than normally taught in introductory courses. One chapter discusses general relativity in a completely non-mathematical way emphasizing the equivalence principle and the generalized principle of relativity; the examples in this chapter can offer a new slant on applications of classical mechanics. Another chapter is devoted to the physics of computer games, sci-fi, superheros, and super weapons for those interested in the intersection of popular culture and science. Professional scientists will find topics that they may find amusing and, in some cases, everyday applications that they had not thought of. Brief tutorials are given for essential concepts (e.g. Newton's laws) and appendixes give technical details for the interested reader.