

By Katherine Freese The Cosmic Cocktail Three Parts Dark Matter Science Essentials Hardcover

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Comprehending as capably as union even more than other will have the funds for each success. next to, the declaration as competently as perception of this By Katherine Freese The Cosmic Cocktail Three Parts Dark Matter Science Essentials Hardcover can be taken as with ease as picked to act.

The Lazy Universe Jennifer Coopersmith 2017 This is a rare book on a rare topic: it is about 'action' and the Principle of Least Action. A surprisingly well-kept secret, these ideas are at the heart of physical science and engineering. Physics is well known as being concerned with grand conservatory principles (e.g. the conservation of energy) but equally important is the optimization principle (such as getting somewhere in the shortest time or with the least resistance). The book explains: why an optimization principle underlies physics, what action is, what 'the Hamiltonian' is, and how new insights into energy, space, and time arise. It assumes some background in the physical sciences, at the level of undergraduate science, but it is not a textbook. The requisite derivations and worked examples are given but may be skim-read if desired. The author draws from Cornelius Lanczos's book "The Variational Principles of Mechanics" (1949 and 1970). Lanczos was a brilliant mathematician and educator, but his book was for a postgraduate audience. The present book is no mere copy with the difficult bits left out - it is original, and a popularization. It aims to explain ideas rather than achieve technical competence, and to show how Least Action leads into the whole of physics.

The Amazing Story of Quantum Mechanics James Kakalios 2012 A highly entertaining exploration of the complicated science of quantum mechanics made easy to understand by way of pop culture. Kakalios explains why the development of quantum mechanics enabled our amazing present day.

Einstein Gravity in a Nutshell A. Zee 2013-05-05 An ideal introduction to Einstein's general theory of relativity This unique textbook provides an accessible introduction to Einstein's general theory of relativity, a subject of breathtaking beauty and supreme importance in physics. With his trademark blend of wit and incisiveness, A. Zee guides readers from the fundamentals of Newtonian mechanics to the most exciting frontiers of research today, including de Sitter and anti-de Sitter spacetimes, Kaluza-Klein theory, and brane worlds. Unlike other books on Einstein gravity, this book emphasizes the action principle and group theory as guides in constructing physical theories. Zee treats various topics in a spiral style that is easy on beginners, and includes anecdotes from the history of physics that will appeal to students and experts alike. He takes a friendly approach to the required mathematics, yet does not shy away from more advanced mathematical topics such as differential forms. The extensive discussion of black holes includes rotating and extremal black

holes and Hawking radiation. The ideal textbook for undergraduate and graduate students, *Einstein Gravity in a Nutshell* also provides an essential resource for professional physicists and is accessible to anyone familiar with classical mechanics and electromagnetism. It features numerous exercises as well as detailed appendices covering a multitude of topics not readily found elsewhere. Provides an accessible introduction to Einstein's general theory of relativity Guides readers from Newtonian mechanics to the frontiers of modern research Emphasizes symmetry and the Einstein-Hilbert action Covers topics not found in standard textbooks on Einstein gravity Includes interesting historical asides Features numerous exercises and detailed appendices Ideal for students, physicists, and scientifically minded lay readers Solutions manual (available only to teachers)

The Little Book of Black Holes Steven S. Gubser 2017-10-10 Dive into a mind-bending exploration of the physics of black holes Black holes, predicted by Albert Einstein's general theory of relativity more than a century ago, have long intrigued scientists and the public with their bizarre and fantastical properties. Although Einstein understood that black holes were mathematical solutions to his equations, he never accepted their physical reality—a viewpoint many shared. This all changed in the 1960s and 1970s, when a deeper conceptual understanding of black holes developed just as new observations revealed the existence of quasars and X-ray binary star systems, whose mysterious properties could be explained by the presence of black holes. Black holes have since been the subject of intense research—and the physics governing how they behave and affect their surroundings is stranger and more mind-bending than any fiction. After introducing the basics of the special and general theories of relativity, this book describes black holes both as astrophysical objects and theoretical “laboratories” in which physicists can test their understanding of gravitational, quantum, and thermal physics. From Schwarzschild black holes to rotating and colliding black holes, and from gravitational radiation to Hawking radiation and information loss, Steven Gubser and Frans Pretorius use creative thought experiments and analogies to

explain their subject accessibly. They also describe the decades-long quest to observe the universe in gravitational waves, which recently resulted in the LIGO observatories' detection of the distinctive gravitational wave “chirp” of two colliding black holes—the first direct observation of black holes' existence. The *Little Book of Black Holes* takes readers deep into the mysterious heart of the subject, offering rare clarity of insight into the physics that makes black holes simple yet destructive manifestations of geometric destiny.

Life's Engines Paul G. Falkowski 2016-12-06 The stewards of Earth, these organisms transformed the chemistry of our planet to make it habitable for plants, animals, and us.

Jesus and Other Men Susanna Asikainen 2018-02-05 In *Jesus and Other Men*, Susanna Asikainen explores the masculinities of Jesus and other male characters and the ideal femininities in the Synoptic Gospels.

The Cosmic Cocktail Katherine Freese 2016-05-17 The ordinary atoms that make up the known universe—from our bodies and the air we breathe to the planets and stars—constitute only 5 percent of all matter and energy in the cosmos. The rest is known as dark matter and dark energy, because their precise identities are unknown. The *Cosmic Cocktail* is the inside story of the epic quest to solve one of the most compelling enigmas of modern science—what is the universe made of?—told by one of today's foremost pioneers in the study of dark matter. Blending cutting-edge science with her own behind-the-scenes insights as a leading researcher in the field, acclaimed theoretical physicist Katherine Freese recounts the hunt for dark matter, from the discoveries of visionary scientists like Fritz Zwicky—the Swiss astronomer who coined the term “dark matter” in 1933—to the deluge of data today from underground laboratories, satellites in space, and the Large Hadron Collider. Theorists contend that dark matter consists of fundamental particles known as WIMPs, or weakly interacting massive particles. Billions of them pass through our bodies every second without us even realizing it, yet their gravitational pull is capable of whirling stars and gas at breakneck speeds around the centers of galaxies, and bending light from distant bright objects. Freese describes the larger-than-life

characters and clashing personalities behind the race to identify these elusive particles. Many cosmologists believe we are on the verge of solving the mystery. The Cosmic Cocktail provides the foundation needed to fully fathom this epochal moment in humankind's quest to understand the universe.

Built to Meet Needs: Cultural Issues in Vernacular Architecture

Paul Oliver 2007-06-07 The study of vernacular architecture explores the characteristics of domestic buildings in particular regions or localities, and the many social and cultural factors that have contributed to their evolution. In this book, vernacular architecture specialist Paul Oliver brings together a wealth of information that spans over two decades, and the whole globe. Some previously unpublished papers, as well as those only available in hard to find conference proceedings, are brought together in one volume to form a fascinating reference for students and professional architects, as well as all those involved with planning housing schemes in their home countries and overseas.

The Large Hadron Collider Don Lincoln 2020-09-29 As accessible as it is fascinating, *The Large Hadron Collider* reveals the inner workings of this masterful achievement of technology, along with the mind-blowing discoveries that will keep it at the center of the scientific frontier for the foreseeable future.

Chilling Cocktails Jason Ward 2021-08-03 "50 creepy drinks inspired by horror stories. Whether it's an entire cinema jumping in unison at "Get Out" or a gory B-movie marathon with friends, a horror film always feels like an event--and any good event deserves a decent drink. 'Chilling Cocktails' is a compendium of cocktails inspired by some of the most significant horror films and books, from 'Alien' to 'Dracula,' 'Hereditary' to 'Halloween,' and more. Each recipe is accompanied by dark and compelling facts about the inspiring story, certain to get you in the mood for a cool refreshment."--Back cover.

Calculating the Cosmos Ian Stewart 2016-09-15 Ian Stewart's up-to-the-minute guide to the cosmos moves from the formation of the Earth and its Moon to the planets and asteroids of the solar system and from there out into the galaxy and the universe. He describes the architecture

of space and time, dark matter and dark energy, how galaxies form, why stars implode, how everything began, and how it will end. He considers parallel universes, what forms extra-terrestrial life might take, and the likelihood of Earth being hit by an asteroid. Mathematics, Professor Stewart shows, has been the driving force in astronomy and cosmology since the ancient Babylonians. He describes how Kepler's work on planetary orbits led Newton to formulate his theory of gravity, and how two centuries later irregularities in the motion of Mars inspired Einstein's theory of general relativity. In crystal-clear terms he explains the fundamentals of gravity, spacetime, relativity and quantum theory, and shows how they all relate to each other. Eighty years ago the discovery that the universe is expanding led to the Big Bang theory of its origins. This in turn led cosmologists to posit features such as dark matter and dark energy. But does dark matter exist? Could another scientific revolution be on the way to challenge current scientific orthodoxy? These are among the questions Ian Stewart raises in his quest through the realms of astronomy and cosmology.

The Elephant in the Universe Govert Schilling 2022-01-01 An award-winning science journalist details the quest to isolate and understand dark matter--and shows how that search has helped us to understand the universe we inhabit. When you train a telescope on outer space, you can see luminous galaxies, nebulae, stars, and planets. But if you add all that together, it constitutes only 15 percent of the matter in the universe. Despite decades of research, the nature of the remaining 85 percent is unknown. We call it dark matter. In *The Elephant in the Universe*, Govert Schilling explores the fascinating history of the search for dark matter. Evidence for its existence comes from a wealth of astronomical observations. Theories and computer simulations of the evolution of the universe are also suggestive: they can be reconciled with astronomical measurements only if dark matter is a dominant component of nature. Physicists have devised huge, sensitive instruments to search for dark matter, which may be unlike anything else in the cosmos--some unknown elementary particle. Yet so far dark matter has escaped every experiment. Indeed, dark matter is so elusive that some scientists are

beginning to suspect there might be something wrong with our theories about gravity or with the current paradigms of cosmology. Schilling interviews both believers and heretics and paints a colorful picture of the history and current status of dark matter research, with astronomers and physicists alike trying to make sense of theory and observation. Taking a holistic view of dark matter as a problem, an opportunity, and an example of science in action, *The Elephant in the Universe* is a vivid tale of scientists puzzling their way toward the true nature of the universe.

Physics and Literature Aura Heydenreich 2021-12-20 DIE REIHE: LITERATUR- UND NATURWISSENSCHAFTEN entsteht unter Federführung des Erlanger Forschungszentrums für Literatur- und Naturwissenschaften (ELINAS). Experten unterschiedlicher Fachkulturen führen darin ihre Methoden zusammen und fragen sowohl nach den Funktionen der Sprache in der naturwissenschaftlichen Forschung als auch nach den Verfahren der Modellierung naturwissenschaftlicher Erkenntnisse in der Literatur. Die Reihe versteht sich als ein interdisziplinäres Forum zur Reflexion der kulturellen Bedeutung natur- und literaturwissenschaftlicher Forschung sowie zur Ethik und Rhetorik wissenschaftlicher Argumentation.

Losing the Nobel Prize: A Story of Cosmology, Ambition, and the Perils of Science's Highest Honor Brian Keating 2018-04-24 *A Forbes, Physics Today, Science News, and Science Friday Best Science Book Of 2018* The inside story of a quest to unlock one of cosmology's biggest mysteries, derailed by the lure of the Nobel Prize. What would it have been like to be an eyewitness to the Big Bang? In 2014, astronomers wielding BICEP2, the most powerful cosmology telescope ever made, revealed that they'd glimpsed the spark that ignited the Big Bang. Millions around the world tuned in to the announcement broadcast live from Harvard University, immediately igniting rumors of an imminent Nobel Prize. But had these cosmologists truly read the cosmic prologue or, swept up in Nobel dreams, had they been deceived by a galactic mirage? In *Losing the Nobel Prize*, cosmologist and inventor of the BICEP (Background Imaging of Cosmic Extragalactic Polarization) experiment Brian Keating tells the inside story of BICEP2's mesmerizing

discovery and the scientific drama that ensued. In an adventure story that spans the globe from Rhode Island to the South Pole, from California to Chile, Keating takes us on a personal journey of revelation and discovery, bringing to vivid life the highly competitive, take-no-prisoners, publish-or-perish world of modern science. Along the way, he provocatively argues that the Nobel Prize, instead of advancing scientific progress, may actually hamper it, encouraging speed and greed while punishing collaboration and bold innovation. In a thoughtful reappraisal of the wishes of Alfred Nobel, Keating offers practical solutions for reforming the prize, providing a vision of a scientific future in which cosmologists may, finally, be able to see all the way back to the very beginning.

Antimatter Beatriz Gato-Rivera 2021-04-10 Antimatter is one of the most fascinating aspects of Particle Physics, and matter-antimatter annihilation the most energetic process in the universe. If they existed, everyday objects made of antimatter would look exactly like those made of ordinary matter, as would antimatter stars. We live surrounded by antimatter, since showers of matter and antimatter particles fall incessantly on the Earth's surface, some of them penetrating our buildings. Furthermore, many things around us - bananas, for example - actually emit antielectrons. This book first introduces the essentials of particle physics and the nature of particles and antiparticles. It describes the discovery of antimatter particles and explains how they are produced, where they are found, and how antistars could be spotted; it also introduces cosmic rays, particle accelerators, dark matter, dark energy and nuclear reactions in stars. The enigma of the matter-antimatter asymmetry in the Universe is discussed as are the very real applications of antimatter in hospitals, in industry and in cutting-edge research and technology. Non-specialist readers will find here a wealth of fascinating and accessible information to deepen their appreciation of antimatter.

Oxygen Donald E. Canfield 2015-12-01 The air we breathe is twenty-one percent oxygen, an amount higher than on any other known world. While we may take our air for granted, Earth was not always an oxygenated

planet. How did it become this way? Donald Canfield—one of the world's leading authorities on geochemistry, earth history, and the early oceans—covers this vast history, emphasizing its relationship to the evolution of life and the evolving chemistry of the Earth. Canfield guides readers through the various lines of scientific evidence, considers some of the wrong turns and dead ends along the way, and highlights the scientists and researchers who have made key discoveries in the field. Showing how Earth's atmosphere developed over time, *Oxygen* takes readers on a remarkable journey through the history of the oxygenation of our planet.

Einstein and the Quantum A. Douglas Stone 2015-10-06 *Einstein and the Quantum* reveals for the first time the full significance of Albert Einstein's contributions to quantum theory. Einstein famously rejected quantum mechanics, observing that God does not play dice. But, in fact, he thought more about the nature of atoms, molecules, and the emission and absorption of light—the core of what we now know as quantum theory—than he did about relativity. A compelling blend of physics, biography, and the history of science, *Einstein and the Quantum* shares the untold story of how Einstein—not Max Planck or Niels Bohr—was the driving force behind early quantum theory. It paints a vivid portrait of the iconic physicist as he grappled with the apparently contradictory nature of the atomic world, in which its invisible constituents defy the categories of classical physics, behaving simultaneously as both particle and wave. And it demonstrates how Einstein's later work on the emission and absorption of light, and on atomic gases, led directly to Erwin Schrödinger's breakthrough to the modern form of quantum mechanics. The book sheds light on why Einstein ultimately renounced his own brilliant work on quantum theory, due to his deep belief in science as something objective and eternal.

In Search of a Theory of Everything Demetris Nicolaides 2020-07 "In Search of a Theory of Everything is an adventurous journey in space and time in search of a unified "theory of everything" (TOE) by means of a rare and agile interplay between the natural philosophies of influential ancient Greek thinkers and the laws of modern physics. For a TOE, all

the phenomena of nature share a subtle underlying commonality and are explainable by a single overarching immutable principle. Reading the past for what it is, is of tremendous value, but so is its reading from the perspective of modern knowledge. Not to judge it for its flaws but to be inspired by its insights. This comparative study of the universe is the spirit of In Search of a Theory of Everything—to physics through philosophy, to the new via the old, and in a balanced way. A relatively "easier" analysis of nature, that of a major natural philosopher of antiquity, commences every chapter to fasten the bedrock for the more complex. The transition into the more complicated views of modern physics is gradual and systematic, entwining finely the two, the ancient with the new, the forgotten with the current, by unfolding a history and a philosophy of science, and connecting all the great feats of the mind and time. Those philosophers had ideas that resonate with aspects of modern science; puzzles that still baffle; and rationales that can be used to reassess completely anew fundamental but competing principles of modern physics, even to speculate about open physics problems. In Search of a Theory of Everything is a new kind of sight, is a philosophical insight of modern physics"—

At the Edge of Time Dan Hooper 2021-04-06 A new look at the first few seconds after the Big Bang—and how research into these moments continues to revolutionize our understanding of our universe Scientists in recent decades have made crucial discoveries about how our cosmos evolved over the past 13.8 billion years. But we still know little about what happened in the first seconds after the Big Bang. *At the Edge of Time* focuses on what we have learned and are striving to understand about this mysterious period at the beginning of cosmic history. Delving into the remarkable science of cosmology, Dan Hooper describes many of the extraordinary questions that scientists are asking about the origin and nature of our world. Hooper examines how the Large Hadron Collider and other experiments re-create the conditions of the Big Bang, how we may finally discover the way dark matter was formed during our universe's first moments, and how, with new telescopes, we are lifting the veil on the era of cosmic inflation. *At the Edge of Time* presents an

accessible investigation of our universe and its birth.

Particle Dark Matter Gianfranco Bertone 2010 Describes the dark matter problem in particle physics, astrophysics and cosmology for graduate students and researchers.

A Most Incomprehensible Thing Peter Collier 2017-04-01 A straightforward, enjoyable guide to the mathematics of Einstein's relativity To really understand Einstein's theory of relativity - one of the cornerstones of modern physics - you have to get to grips with the underlying mathematics. This self-study guide is aimed at the general reader who is motivated to tackle that not insignificant challenge. With a user-friendly style, clear step-by-step mathematical derivations, many fully solved problems and numerous diagrams, this book provides a comprehensive introduction to a fascinating but complex subject. For those with minimal mathematical background, the first chapter gives a crash course in foundation mathematics. The reader is then taken gently by the hand and guided through a wide range of fundamental topics, including Newtonian mechanics; the Lorentz transformations; tensor calculus; the Einstein field equations; the Schwarzschild solution (which gives a good approximation of the spacetime of our Solar System); simple black holes, relativistic cosmology and gravitational waves. Special relativity helps explain a huge range of non-gravitational physical phenomena and has some strangely counter-intuitive consequences. These include time dilation, length contraction, the relativity of simultaneity, mass-energy equivalence and an absolute speed limit. General relativity, the leading theory of gravity, is at the heart of our understanding of cosmology and black holes. "I must observe that the theory of relativity resembles a building consisting of two separate stories, the special theory and the general theory. The special theory, on which the general theory rests, applies to all physical phenomena with the exception of gravitation; the general theory provides the law of gravitation and its relations to the other forces of nature." - Albert Einstein, 1919 Understand even the basics of Einstein's amazing theory and the world will never seem the same again. Contents: Preface Introduction 1 Foundation mathematics 2 Newtonian mechanics 3

Special relativity 4 Introducing the manifold 5 Scalars, vectors, one-forms and tensors 6 More on curvature 7 General relativity 8 The Newtonian limit 9 The Schwarzschild metric 10 Schwarzschild black holes 11 Cosmology 12 Gravitational waves Appendix: The Riemann curvature tensor Bibliography Acknowledgements January 2019. This third edition has been revised to make the material even more accessible to the enthusiastic general reader who seeks to understand the mathematics of relativity.

Cosmic Cocktail Katherine Freese

Neutrino Mass Guido Altarelli 2003-09-08 Reviews the current state of knowledge of neutrino masses and the related question of neutrino oscillations. After an overview of the theory of neutrino masses and mixings, detailed accounts are given of the laboratory limits on neutrino masses, astrophysical and cosmological constraints on those masses, experimental results on neutrino oscillations, the theoretical interpretation of those results, and theoretical models of neutrino masses and mixings. The book concludes with an examination of the potential of long-baseline experiments. This is an essential reference text for workers in elementary-particle physics, nuclear physics, and astrophysics.

First Light Emma Chapman 2021-02-23 First Light opens a window into a previously dark and secret time in our Universe's history - the time when the first stars were born.

The Science of Can and Can't Chiara Marletto 2021-05-04 A young theoretical physicist's guide to how the radical new science of counterfactuals can reveal the full scope of our universe There is a vast class of properties that science has so far almost entirely neglected. These properties are central to an understanding of physical reality both at an everyday level and at the level of fundamental phenomena, yet they have traditionally been thought of as impossible to incorporate into fundamental explanations. They relate not only to what is true - the actual - but to what could be true - the counterfactual. This is the science of can and can't. Chiara Marletto, a pioneer in this field, explores the promise that this fascinating, far-reaching approach holds not only for revolutionizing how fundamental physics is formulated, but also for

confronting existing technological challenges, from delivering the next generation of information-processing devices to designing AI. In each chapter, Marletto sets out how counterfactuals can solve a vexed open problem in science, and demonstrates that by contemplating the possible as well as the actual, we can break down barriers to knowledge and form a more complete and fruitful picture of the universe. 'Clear, sharp and imaginative... The Science of Can and Can't will open the doors to a dazzling set of concepts and ideas that will change deeply the way you look at the world' David Deutsch, bestselling author of *The Beginning of Infinity*

Nature's Blueprint Dan Hooper 2008-09-16 An accessible introduction to the physics theory about supersymmetry explains its potential for resolving key gaps in particle physics and rendering the universe more predictable, in a guide for lay readers that explains basic tenets in a comprehensive and lighthearted style. 20,000 first printing.

Life's Engines Paul G. Falkowski 2015-04-27 The marvelous microbes that made life on Earth possible and support our very existence For almost four billion years, microbes had the primordial oceans all to themselves. The stewards of Earth, these organisms transformed the chemistry of our planet to make it habitable for plants, animals, and us. *Life's Engines* takes readers deep into the microscopic world to explore how these marvelous creatures made life on Earth possible—and how human life today would cease to exist without them. Paul Falkowski looks "under the hood" of microbes to find the engines of life, the actual working parts that do the biochemical heavy lifting for every living organism on Earth. With insight and humor, he explains how these miniature engines are built—and how they have been appropriated by and assembled like Lego sets within every creature that walks, swims, or flies. Falkowski shows how evolution works to maintain this core machinery of life, and how we and other animals are veritable conglomerations of microbes. A vibrantly entertaining book about the microbes that support our very existence, *Life's Engines* will inspire wonder about these elegantly complex nanomachines that have driven life since its origin. It also issues a timely warning about the dangers of

tinkering with that machinery to make it more "efficient" at meeting the ever-growing demands of humans in the coming century.

Einstein's Telescope: The Hunt for Dark Matter and Dark Energy in the Universe Evalyn Gates 2010-02-22 "Splendidly satisfying reading, designed for a nonspecialist audience."—Kirkus Reviews, starred review Evalyn Gates, a talented astrophysicist, transports readers to the edge of contemporary science to explore the revolutionary tool—"Einstein's telescope"—that is unlocking the secrets of the Universe. Einstein's telescope, or gravitational lensing, is so-called for the way gravity causes space to distort and allow massive objects to act like "lenses," amplifying and distorting the images of objects behind them. By allowing for the detection of mass where no light is found, scientists can map out the distribution of dark matter and come a step closer to teasing out the effects of dark energy on the Universe—which may forever upend long-held notions about where the Universe came from and where it is going.

Classical and Christian Ideas in English Renaissance Poetry Isabel Rivers 2003-09-02 Since publication in 1979 Isabel Rivers' sourcebook has established itself as the essential guide to English Renaissance poetry. It: provides an account of the main classical and Christian ideas, outlining their meaning, their origins and their transmission to the Renaissance; illustrates the ways in which Renaissance poetry drew on classical and Christian ideas; contains extracts from key classical and Christian texts and relates these to the extracts of the English poems which draw on them; includes suggestions for further reading, and an invaluable bibliographical appendix.

An Introduction to Cultural Ecology Mark Q. Sutton 2020-08-26 This contemporary introduction to the principles and research base of cultural ecology is the ideal textbook for advanced undergraduate and beginning graduate courses that deal with the intersection of humans and the environment in traditional societies. After introducing the basic principles of cultural anthropology, environmental studies, and human biological adaptations to the environment, the book provides a thorough discussion of the history of, and theoretical basis behind, cultural

ecology. The bulk of the book outlines the broad economic strategies used by traditional cultures: hunting/gathering, horticulture, pastoralism, and agriculture. Fully explicated with cases, illustrations, and charts on topics as diverse as salmon ceremonies among Northwest Indians, contemporary Maya agriculture, and the sacred groves in southern China, this book gives a global view of these strategies. An important emphasis in this text is on the nature of contemporary ecological issues, how peoples worldwide adapt to them, and what the Western world can learn from their experiences. A perfect text for courses in anthropology, environmental studies, and sociology.

Dark Cosmos Dan Hooper 2009-10-06 The twentieth century was astonishing in all regards, shaking the foundations of practically every aspect of human life and thought, physics not least of all. Beginning with the publication of Albert Einstein's theory of relativity, through the wild revolution of quantum mechanics, and up until the physics of the modern day (including the astonishing revelation, in 1998, that the Universe is not only expanding, but doing so at an ever-quickenning pace), much of what physicists have seen in our Universe suggests that much of our Universe is unseen—that we live in a dark cosmos. Everyone knows that there are things no one can see—the air you're breathing, for example, or, to be more exotic, a black hole. But what everyone does not know is that what we can see—a book, a cat, or our planet—makes up only 5 percent of the Universe. The rest—fully 95 percent—is totally invisible to us; its presence discernible only by the weak effects it has on visible matter around it. This invisible stuff comes in two varieties—dark matter and dark energy. One holds the Universe together, while the other tears it apart. What these forces really are has been a mystery for as long as anyone has suspected they were there, but the latest discoveries of experimental physics have brought us closer to that knowledge. Particle physicist Dan Hooper takes his readers, with wit, grace, and a keen knack for explaining the toughest ideas science has to offer, on a quest few would have ever expected: to discover what makes up our dark cosmos.

An Infinity of Worlds Will Kinney 2022-04-05 What happened before

the primordial fire of the Big Bang: a theory about the ultimate origin of the universe. In the beginning was the Big Bang: an unimaginably hot fire almost fourteen billion years ago in which the first elements were forged. The physical theory of the hot nascent universe—the Big Bang—was one of the most consequential developments in twentieth-century science. And yet it leaves many questions unanswered: Why is the universe so big? Why is it so old? What is the origin of structure in the cosmos? In *An Infinity of Worlds*, physicist Will Kinney explains a more recent theory that may hold the answers to these questions and even explain the ultimate origins of the universe: cosmic inflation, before the primordial fire of the Big Bang. Kinney argues that cosmic inflation is a transformational idea in cosmology, changing our picture of the basic structure of the cosmos and raising unavoidable questions about what we mean by a scientific theory. He explains that inflation is a remarkable unification of inner space and outer space, in which the physics of the very large (the cosmos) meets the physics of the very small (elementary particles and fields), closing in a full circle at the first moment of time. With quantum uncertainty its fundamental feature, this new picture of cosmic origins introduces the possibility that the origin of the universe was of a quantum nature. Kinney considers the consequences of eternal cosmic inflation. Can we come to terms with the possibility that our entire observable universe is one of infinitely many, forever hidden from our view?

A Journey through the Universe Ian Morison 2014-09-25 A comprehensive, up-to-date survey of our knowledge of the Universe beyond Earth, for general readers and astronomy enthusiasts.

Gallucci's Commentary on Dürer's 'Four Books on Human Proportion' James Hutson 2020-10-09 In 1591, Giovanni Paolo Gallucci published his *Della simmetria dei corpi humani*, an Italian translation of Albrecht Dürer's *Four Books on Human Proportion*. While Dürer's treatise had been translated earlier in the sixteenth-century into French and Latin, it was Gallucci's Italian translation that endured in popularity as the most cited version of the text in later Baroque treatises, covering topics that were seen as central to arts education, connoisseurship,

patronage, and the wider appreciation of the studia humanitatis in general. The text centres on the relationships between beauty and proportion, macrocosm and microcosm: relationships that were not only essential to the visual arts in the early modern era, but that cut across a range of disciplines - music, physiognomics and humoral readings, astronomy, astrology and cosmology, theology and philosophy, even mnemonics and poetry. In his version of the text, Gallucci expanded the educational potential of the treatise by adding a Preface, a Life of Dürer, and a Fifth Book providing a philosophical framework within which to interpret Dürer's previous sections. This translation is the first to make these original contributions by Gallucci accessible to an English-speaking audience. Gallucci's contributions illuminate the significance of symmetry and proportion in the contemporary education of the early modern era, informing our understanding of the intellectual history of this period, and the development of art theory and criticism. This is a valuable resource to early modern scholars and students alike, especially those specialising in history of art, philosophy, history of science, and poetry. This work was published by Saint Philip Street Press pursuant to a Creative Commons license permitting commercial use. All rights not granted by the work's license are retained by the author or authors.

Our Universe Jo Dunkley 2019-04-08 Jo Dunkley combines her expertise as an astrophysicist with her talents as a writer and teacher to present an elegant introduction to the structure, history, and enduring mysteries of the universe. Among the cutting-edge phenomena discussed are the accelerating expansion of the universe and the possibility that our universe is only one of many.

Alien Oceans Kevin Hand 2021-09-21 Inside the epic quest to find life on the water-rich moons at the outer reaches of the solar system Where is the best place to find life beyond Earth? We often look to Mars as the most promising site in our solar system, but recent scientific missions have revealed that some of the most habitable real estate may actually lie farther away. Beneath the frozen crusts of several of the small, ice-covered moons of Jupiter and Saturn lurk vast oceans that may have existed for as long as Earth, and together may contain more than fifty

times its total volume of liquid water. Could there be organisms living in their depths? *Alien Oceans* reveals the science behind the thrilling quest to find out. Kevin Peter Hand is one of today's leading NASA scientists, and his pioneering research has taken him on expeditions around the world. In this captivating account of scientific discovery, he brings together insights from planetary science, biology, and the adventures of scientists like himself to explain how we know that oceans exist within moons of the outer solar system, like Europa, Titan, and Enceladus. He shows how the exploration of Earth's oceans is informing our understanding of the potential habitability of these icy moons, and draws lessons from what we have learned about the origins of life on our own planet to consider how life could arise on these distant worlds. *Alien Oceans* describes what lies ahead in our search for life in our solar system and beyond, setting the stage for the transformative discoveries that may await us.

The 4-Percent Universe Richard Panek 2012-03-01 Meet the players in the most fundamental scientific revolution since Copernicus The Facts of Matter It is one of the most disturbing aspects of our universe: only four per cent of it consists of the matter that makes up every star, planet, and every book. The rest is completely unknown. Acclaimed science writer Richard Panek tells the story of the handful of scientists who have spent the past few decades on a quest to unlock the secrets of "dark matter" and the even stranger substance called "dark energy". These are perhaps the greatest mysteries in science, and solving them will reshape our understanding of the universe and our place in it. The stakes could not be higher. Panek's fast-paced narrative, filled with original, in-depth reporting and intimate, behind-the-scenes details, brings this epic story to life for the very first time.

Heart of Darkness Jeremiah P. Ostriker 2015-05-26 Humanity's ongoing quest to unlock the secrets of dark matter and dark energy *Heart of Darkness* describes the incredible saga of humankind's quest to unravel the deepest secrets of the universe. Over the past thirty years, scientists have learned that two little-understood components—dark matter and dark energy—comprise most of the known cosmos, explain

the growth of all cosmic structure and hold the key to the universe's fate. The story of how evidence for the so-called "Lambda-Cold Dark Matter" model of cosmology has been gathered by generations of scientists throughout the world is told here by one of the pioneers of the field, Jeremiah Ostriker, and his coauthor Simon Mitton. From humankind's early attempts to comprehend Earth's place in the solar system, to astronomers' exploration of the Milky Way galaxy and the realm of the nebulae beyond, to the detection of the primordial fluctuations of energy from which all subsequent structure developed, this book explains the physics and the history of how the current model of our universe arose and has passed every test hurled at it by the skeptics. Throughout this rich story, an essential theme is emphasized: how three aspects of rational inquiry—the application of direct measurement and observation, the introduction of mathematical modeling, and the requirement that hypotheses should be testable and verifiable—guide scientific progress and underpin our modern cosmological paradigm. This monumental puzzle is far from complete, however, as scientists confront the mysteries of the ultimate causes of cosmic structure formation and the real nature and origin of dark matter and dark energy.

The Telescope in the Ice Mark Bowen 2017-11-14 IceCube Observatory, a South Pole instrument making the first actual observations of high-energy neutrinos, has been called the “weirdest” of the seven wonders of modern astronomy by Scientific American. In *The Telescope in the Ice*, Mark Bowen tells the amazing story of the people who built the instrument and the science involved. Located near the U. S. Amundsen-Scott Research Station at the geographic South Pole, IceCube

is unlike most telescopes in that it is not designed to detect light. It employs a cubic kilometer of diamond-clear ice, more than a mile beneath the surface, to detect an elementary particle known as the neutrino. In 2010, it detected the first extraterrestrial high-energy neutrinos and thus gave birth to a new field of astronomy. IceCube is also the largest particle physics detector ever built. Its scientific goals span not only astrophysics and cosmology but also pure particle physics. And since the neutrino is one of the strangest and least understood of the known elementary particles, this is fertile ground. Neutrino physics is perhaps the most active field in particle physics today, and IceCube is at the forefront. *The Telescope in the Ice* is, ultimately, a book about people and the thrill of the chase: the struggle to understand the neutrino and the pioneers and inventors of neutrino astronomy.

Brave New Arctic Mark C. Serreze 2020-03-03 An insider account of how scientists unraveled the mystery of the thawing Arctic In the 1990s, researchers in the Arctic noticed that floating summer sea ice had begun receding. This was accompanied by shifts in ocean circulation and unexpected changes in weather patterns throughout the world. The Arctic's perennially frozen ground, known as permafrost, was warming, and treeless tundra was being overtaken by shrubs. What was going on? *Brave New Arctic* is Mark Serreze's riveting firsthand account of how scientists from around the globe came together to find answers. In a sweeping tale of discovery spanning three decades, Serreze describes how puzzlement turned to alarm as researchers concluded that the Arctic is rapidly thawing due to climate change—and humans are to blame.