How The Hippies Saved Physics

Quantum mechanics is an extraordinarily successful scientific theory. But more than 100 years after it was first introduced, the interpretation of the theory remains controversial. This Element introduces some of the most puzzling questions at the foundations of quantum mechanics and provides an up-to-date and forward-looking survey of the most prominent ways in which physicists and philosophers of physics have attempted to resolve them. Topics covered include nonlocality, contextuality, the reality of the wavefunction and the measurement problem. The discussion is supplemented with descriptions of some of the most important mathematical results from recent work in quantum foundations, including Bell's theorem, the Kochen-Specker theorem and the PBR theorem.

"Entertaining, insightful and simply brilliant. Quantum Physics for Hippies shatters your perception of reality." - Dr. Mark Müller Bob, a spiritual hippie, meets the witty nerd Alice, who day-dreams about quantum physics all day long. This chance meeting starts them on a mind-blowing journey into the nature of reality that will change their lives forever. Written by quantum physicists and beautifully illustrated, Quantum Physics for Hippies takes the bizarre world of quantum physics and makes it understandable for everyone, hippies and nerds alike. Is this book for you? If you would love to know what quantum physics is really about, but complicated explanations or equations put you off, then this book is for you. Why? We found that there are two types of books about quantum physics. Type A is written by nerds. Usually, they have hundreds of pages, a lot of equations and bury you in useless details. They are mostly correct, but not fun to read. Type B is written by esoterics. They are easy to read, but often full of nonsense, not helping at all in your mission to find the truth. So we decided to write a new type of quantum physics book. Type Hippie-Nerd! Easy, fun to read and correct all at the same time, while still blowing your mind. Happy Readings!

One of Smithsonian's Favorite Books of 2018 One of Forbes's 2018 Best Books About Astronomy, Physics and Mathematics One of Kirkus's Best Books of 2018 The intellectual adventure story of the "double-slit" experiment, showing how a sunbeam split into two paths first challenged our understanding of light and then the nature of reality itself--and continues to almost 200 years later. Many of science's greatest minds have grappled with the simple yet elusive "double-slit" experiment. Thomas Young devised it in the early 1800s to show that light behaves like a wave, and in doing so opposed Isaac Newton. Nearly a century later, Albert Einstein showed that light comes in quanta, or particles, and the experiment became key to a fierce debate between Einstein and Niels Bohr over the nature of reality. Richard Feynman held that the double slit embodies the central mystery of the quantum world. Decade after decade, hypothesis after hypothesis, scientists have returned to this ingenious experiment to help them answer deeper and deeper questions about the fabric of the universe. How can a single particle behave both like a particle and a wave? Does a particle exist before we look at it, or does the very act of looking create reality? Are there hidden aspects to reality missing from the orthodox view of quantum physics? Is there a place where the quantum world ends and the familiar classical world of our daily lives begins, and if so, can we find it? And if there's no such place, then does the universe split into two each time a particle goes through the double slit? With his extraordinarily gifted eloquence, Anil Ananthaswamy travels around the world and through history, down to the smallest scales of physical reality we have yet fathomed. Through Two Doors at Once is the most fantastic voyage you can take.

“Multiverse” cosmologies imagine our universe as just one of a vast number of others. While this idea has captivated philosophy, religion, and literature for millennia, it is now being considered as a scientific hypothesis—with different models emerging from cosmology, quantum mechanics, and string theory. Beginning with ancient Atomist and Stoic philosophies, Mary-Jane Rubenstein links contemporary models of the multiverse to their forerunners and explores their current emergence. One reason is the so-called fine-tuning of the universe: nature’s constants are so delicately calibrated, it seems they have been set just right to allow life to emerge. For some theologians, these “fine-tunings” are proof of God; for others, “God” is an insufficient explanation. One compelling solution: if all possible worlds exist somewhere, then it is no surprise one of them happens to be suitable for life. Yet this hypothesis replaces God with an equally baffling article of faith: the existence of universes beyond, before, or after our own, eternally generated yet forever inaccessible. In sidestepping metaphysics, multiverse scenarios collide with it, producing their own counter-theological narratives. Rubenstein argues, however, that this interdisciplinary collision provides the condition of its scientific viability, reconfiguring the boundaries among physics, philosophy, and religion.

The surprising story of eccentric young scientists who stood up to convention—and changed the face of modern physics. Today, quantum information theory is among the most exciting scientific frontiers, attracting billions of dollars in funding and thousands of talented researchers. But as MIT physicist and historian David Kaiser reveals, this cutting-edge field has a surprisingly psychedelic past. How the Hippies Saved Physics introduces us to a band of freewheeling physicists who defied the imperative to “shut up and calculate” and helped to rejuvenate modern physics. For physicists, the 1970s were a time of stagnation. Jobs became scarce, and conformity was encouraged, sometimes stifling exploration of the mysteries of the physical world.

Dissatisfied, underemployed, and eternally curious, an eccentric group of physicists in Berkeley, California, banded together to throw off the constraints of the physics mainstream and explore the wilder side of science. Dubbing themselves the "Fundamental Fysiks Group," they pursued an audacious, speculative approach to physics. They studied quantum entanglement and Bell's Theorem through the lens of Eastern mysticism and psychic mind-reading, discussing the latest research while lounging in hot tubs. Some even dabbled with LSD to enhance their creativity. Unlikely as it may seem, these iconoclasts spun modern physics in a new direction, forcing mainstream physicists to pay attention to the strange but exciting underpinnings of quantum theory. A lively, entertaining story that illuminates the relationship between creativity and scientific progress, How the Hippies Saved Physics takes us to a time when only the unlikeliest heroes could break the science world out of its rut.

For the Love of Physics

Foundations of Quantum Mechanics

Eureka

The Road to Relativity

The Unfinished Quest for the Meaning of Quantum Physics

Cosmology's Century

"Meticulously researched and unapologetically romantic, How the Hippies Saved Physics makes the history of science fun again." —Science In the 1970s, an eccentric group of physicists in Berkeley, California, banded together to explore the wilder side of science. Dubbing themselves the "Fundamental Fysiks Group," they pursued an audacious, speculative approach to physics, studying quantum entanglement in terms of Eastern mysticism and psychic mind reading. As David Kaiser reveals, these unlikely heroes spun modern physics in a new direction, forcing mainstream physicists to pay attention to the strange but exciting underpinnings of quantum theory.

Largely autobiographical account of the author's life as one who fell in love first with physics and then with teaching physics to students.

NAMED ONE OF THE BEST BOOKS OF THE YEAR BY KIRKUS REVIEWS In a memoir of family bonding and cutting-edge physics for readers of Brian Greene's The Hidden Reality and Jim Holt's Why Does the World Exist?, Amanda Gefter tells the story of how she conned her way into a career as a science journalist—and wound up hanging out, talking shop, and butting heads with the world's most brilliant minds. At a Chinese restaurant outside of Philadelphia, a father asks his fifteen-year-old daughter a deceptively simple question: "How would you define nothing?" With that, the girl who once tried to fail geometry as a conscientious objector starts reading up on general relativity and quantum mechanics, as she and her dad embark on a life-altering quest for the answers to the universe's greatest mysteries. Before Amanda Gefter became an accomplished science writer, she was a twenty-one-year-old magazine assistant willing to sneak her and her father, Warren, into a conference devoted to their physics hero, John Wheeler. Posing as journalists, Amanda and Warren met Wheeler, who offered them cryptic clues to the nature of reality: The universe is a self-excited circuit, he said. And, The boundary of a boundary is zero. Baffled, Amanda and Warren vowed to decode the phrases—and with them, the enigmas of existence. When we solve all that, they agreed, we'll write a book. Trespassing on Einstein's Lawn is that book, a memoir of the impassioned hunt that takes Amanda and her father from New York to London to Los Alamos. Along the way, they bump up against quirky science and even quirkier personalities, including Leonard Susskind, the former Bronx plumber who invented string theory; Ed Witten, the soft-spoken genius who coined the enigmatic M-theory; even Stephen Hawking. What they discover is extraordinary: the beginnings of a monumental paradigm shift in cosmology, from a single universe we all share to a splintered reality in which each observer has her own. Reality, the Gefters learn, is radically observer-dependent, far beyond anything of which Einstein or the founders of quantum mechanics ever dreamed—with shattering consequences for our understanding of the universe's origin. And somehow it all ties back to that conversation, to that Chinese restaurant, and to the true meaning of nothing. Throughout their journey, Amanda struggles to make sense of her own life—as her journalism career transforms from illusion to reality, as she searches for her voice as a writer, as she steps from a universe shared with her father to at last carve out one of her own. It's a paradigm shift you might call growing up. By turns hilarious, moving, irreverent, and profound, Trespassing on Einstein's Lawn weaves together story and science in remarkable ways. By the end, you will never look at the universe the same way again. Praise for Trespassing on Einstein's Lawn "Nothing quite prepared me for this book. Wow. Reading it, I alternated between depression—how could the rest of us science writers ever match this?—and exhilaration."—Scientific American "To Do: Read Trespassing on Einstein's Lawn. Reality doesn't have to bite."—New York "A zany superposition of genres . . . It's at once a coming-of-age chronicle and a father-daughter road trip to the far reaches of this universe and 10,500 others."—The Philadelphia Inquirer

Cosmological Koans invites the reader into an intellectual adventure of the highest order. Through more than fifty Koans—pleasingly paradoxical vignettes following the ancient Zen tradition—leading physicist Anthony Aguirre takes the reader across the world from West to East, and through ideas spanning the age, breadth, and depth of the Universe. Using these beguiling Koans (Could there be a civilization on a mote of dust? How much of your fate have you made? Who cleans the universe?) and a flair for explaining complex science, Aguirre covers cosmic questions that scientific giants from Aristotle to Galileo to Heisenberg have grappled with, from the meaning of quantum theory and the nature of time to the origin of multiple universes. A playful and enlightening book, Cosmological Koans explores the strange hinterland between the deep structure of the physical world and our personal experience of it, giving readers what Einstein himself called "the most beautiful and deepest experience" anyone can have: a sense of the mysterious.

The untold story of the heretical thinkers who dared to question the nature of our quantum universe Every physicist agrees quantum mechanics is among humanity's finest scientific achievements. But ask what it means, and the result will be a brawl. For a century, most physicists have followed Niels Bohr's Copenhagen interpretation and dismissed questions about the reality underlying quantum physics as meaningless. A mishmash of solipsism and poor reasoning, Copenhagen endured, as Bohr's students vigorously protected his legacy, and the physics community favored practical experiments over philosophical arguments. As a result, questioning the status quo long meant professional ruin. And yet, from the 1920s to today, physicists like John Bell, David Bohm, and Hugh Everett persisted in seeking the true meaning of quantum mechanics. What Is Real? is the gripping story of this battle of ideas and the courageous scientists who dared to stand up for truth.

Losing the Nobel Prize: A Story of Cosmology, Ambition, and the Perils of Science's Highest Honor

Smoke Rings, Circlons, and Alternative Theories of Everything

How Relativity Triumphed Amid the Vicious Nationalism of World War I

What Is Real?

The History and Meaning of Einstein's Princeton Lectures

Quantum Steampunk

From Einstein to Quantum Teleportation

For the past fifteen years, acclaimed science writer Margaret Wertheim has been collecting the works of "outsider physicists," many without formal training and all convinced that they have found true alternative theories of the universe. Jim Carter, the Einstein of outsiders, has developed his own complete theory of matter and energy and gravity

that he demonstrates with experiments in his backyard,-with garbage cans and a disco fog machine he makes smoke rings to test his ideas about atoms. Captivated by the imaginative power of his theories and his resolutely DIY attitude, Wertheim has been following Carter's progress for the past decade. Centuries ago, natural philosophers puzzled out the laws of nature using the tools of observation and experimentation. Today, theoretical physics has become mathematically inscrutable, accessible only to an elite few. In rejecting this abstraction, outsider theorists insist that nature speaks a language we can all understand. Through a profoundly human profile of Jim Carter, Wertheim's exploration of the bizarre world of fringe physics challenges our conception of what science is, how it works, and who it is for.

Einstein's steadfast refusal to accept certain aspects of quantum theory was rooted in his insistence that physics has to be about reality. Accordingly, he once derided as "spooky action at a distance" the notion that two elementary particles far removed from each other could nonetheless influence each other's properties—a hypothetical phenomenon his fellow theorist Erwin Schrödinger termed "quantum entanglement." In a series of ingenious experiments conducted in various locations—from a dank sewage tunnel under the Danube River to the balmy air between a pair of mountain peaks in the Canary Islands—the author and his colleagues have demonstrated the reality of such entanglement using photons, or light quanta, created by laser beams. In principle the lessons learned may be applicable in other areas, including the eventual development of quantum computers.

Paul Dirac was among the great scientific geniuses of the modern age. One of the discoverers of quantum mechanics, the most revolutionary theory of the past century, his contributions had a unique insight, eloquence, clarity, and mathematical power. His prediction of antimatter was one of the greatest triumphs in the history of physics. One of Einstein ' s most admired colleagues, Dirac was in 1933 the youngest theoretician ever to win the Nobel Prize in physics. Dirac ' s personality is legendary. He was an extraordinarily reserved loner, relentlessly literal-minded and appeared to have no empathy with most people. Yet he was a family man and was intensely loyal to his friends. His tastes in the arts ranged from Beethoven to Cher, from Rembrandt to Mickey Mouse. Based on previously undiscovered archives, The Strangest Man reveals the many facets of Dirac ' s brilliantly original mind. A compelling human story, The Strangest Man also depicts a spectacularly exciting era in scientific history.

Pre-publication subtitle: The birth of relativity amid the vicious nationalism of World War I.

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.

The Many Lives of the Multiverse

Nobel Prize Women in Science

Becoming MIT

(And Why Anything That Can Happen, Does)

Science, Counterculture, and the Quantum Revival

"What Do You Care What Other People Think?": Further Adventures of a Curious Character

The Strangest Man

'This is about gob-smacking science at the far end of reason ... Take it nice and easy and savour the experience of your mind being blown without recourse to hallucinogens' Nicholas Lezard, Guardian For most people, quantum theory is a byword for mysterious, impenetrable science. And yet for many years it was equally baffling for scientists themselves. In this magisterial book, Manjit Kumar gives a dramatic and superbly-written history of this fundamental scientific revolution, and the divisive debate at its core. Quantum theory looks at the very building blocks of our world, the particles and processes without which it could not exist. Yet for 60 years most physicists believed that quantum theory denied the very existence of reality itself. In this tour de force of science history, Manjit Kumar shows how the golden age of physics ignited the greatest intellectual debate of the twentieth century. Quantum theory is weird. In 1905, Albert Einstein suggested that light was a particle, not a wave, defying a century of experiments. Werner Heisenberg's uncertainty principle and Erwin Schrodinger's famous dead-and-alive cat are similarly strange. As Niels Bohr said, if you weren't shocked by quantum theory, you didn't really understand it. While "Quantum" sets the science in the context of the great upheavals of the modern age, Kumar's centrepiece is the conflict between Einstein and Bohr over the nature of reality and the soul of science. 'Bohr brainwashed a whole generation of physicists into believing that the problem had

been solved', lamented the Nobel Prize-winning physicist Murray Gell-Mann. But in "Quantum", Kumar brings Einstein back to the centre of the quantum debate. "Quantum" is the essential read for anyone fascinated by this complex and thrilling story and by the band of brilliant men at its heart.

A pithy yet deep introduction to Einstein’s general theory of relativity Of the four fundamental forces of nature, gravity might be the least understood and yet the one with which we are most intimate. On Gravity combines depth with accessibility to take us on a compelling tour of Einstein's general theory of relativity. A. Zee begins with the discovery of gravity waves, then explains how gravity can be understood in comparison to other classical field theories, presents the idea of curved spacetime, and explores black holes and Hawking radiation. Zee travels as far as the theory reaches, leaving us with tantalizing hints of the unknown, from the intransigence of quantum gravity to the mysteries of dark matter. Infused with Zee’s signature warmth and fresh style, On Gravity opens a unique pathway to comprehending relativity, gravity, spacetime, and the workings of the universe.

First published in 1922 and based on lectures delivered in May 1921, Albert Einstein’s The Meaning of Relativity offered an overview and explanation of the then new and controversial theory of relativity. The work would go on to become a monumental classic, printed in numerous editions and translations worldwide. Now, The Formative Years of Relativity introduces Einstein’s masterpiece to new audiences. This beautiful volume contains Einstein’s insightful text, accompanied by important historical materials and commentary looking at the origins and development of general relativity. Hanoch Gutfreund and Jürgen Renn provide fresh, original perspectives, placing Einstein’s achievements into a broader context for all readers. In this book, Gutfreund and Renn tell the rich story behind the early reception, spread, and consequences of Einstein’s ideas during the formative years of general relativity in the late 1910s and 1920s. They show that relativity’s meaning changed radically throughout the nascent years of its development, and they describe in detail the transformation of Einstein’s work from the esoteric pursuit of one individual communicating with a handful of colleagues into the preoccupation of a growing community of physicists, astronomers, mathematicians, and philosophers. This handsome edition quotes extensively from Einstein’s correspondence and reproduces historical documents such as newspaper articles and letters. Inserts are featured in the main text giving concise explanations of basic concepts, and short biographical notes and photographs of some of Einstein’s contemporaries are included. The first-ever English translations of two of Einstein’s popular Princeton lectures are featured at the book’s end.

Since 1901 there have been over three hundred recipients of the Nobel Prize in the sciences. Only ten of them -- about 3 percent -- have been women. Why? In this updated version of Nobel Prize Women in Science, Sharon Bertsch McGrayne explores the reasons for this astonishing disparity by examining the lives and achievements of fifteen women scientists who either won a Nobel Prize or played a crucial role in a Nobel Prize - winning project. The book reveals the relentless discrimination these women faced both as students and as researchers. Their success was due to the fact that they were passionately in love with science. The book begins with Marie Curie, the first woman to win the Nobel Prize in physics. Readers are then introduced to Christiane Nusslein-Volhard, Emmy Noether, Lise Meitner, Barbara McClintock, Chien-Shiung Wu, and Rosalind Franklin. These and other remarkable women portrayed here struggled against gender discrimination, raised families, and became political and religious leaders. They were mountain climbers, musicians, seamstresses, and gourmet cooks. Above all, they were strong, joyful women in love with discovery. Nobel Prize Women in Science is a startling and revealing look into the history of science and the critical and inspiring role that women have played in the drama of scientific progress.

How the Hippies Saved PhysicsScience, Counterculture, and the Quantum RevivalW.W. Norton & Company

Why Nobody Understands Quantum Mechanics (A Serious Comic on Entanglement)

The Quantum Universe

Quantum Legacies

The Elegant Experiment That Captures the Enigma of Our Quantum Reality

A Father, a Daughter, the Meaning of Nothing, and the Beginning of Everything

From the End of the Rainbow to the Edge of Time - A Journey Through the Wonders of Physics

Einstein's War

When it comes to science, too often people say "I just don't have the brains for it" -- and leave it at that. Why is science so intimidating, and why do people let themselves feel this way? What makes one person a scientist and another disinclined even to learn how to read graphs? The idea that scientists are people who wear lab coats and are somehow smarter than the rest of us is a common, yet dangerous, misconception that puts science on an intimidating pedestal. How did science become so divorced from everyday experience? In Eureka, science popularizer Chad Orzel argues that even the people who are most forthright about hating science are doing science, often without even knowing it. Orzel shows that science is central to the human experience: every human can think like a scientist, and regularly does so in the course of everyday activities. The common misconception is that science is a body of (boring, abstract,

often mathematical) facts. In truth, science is a process: Looking at the world, Thinking about what makes it work, Testing your mental model by comparing it to reality, and Telling others about your results -- all things that people do daily. By revealing the connection between the everyday activities that people do -- solving crossword puzzles, playing sports, or even watching mystery shows on television -- and the processes used to make great scientific discoveries, Eureka shows that this process is one everybody uses regularly, and something that anyone can do.

The New York Times best-selling sequel to "Surely You're Joking, Mr. Feynman!" One of the greatest physicists of the twentieth century, Richard Feynman possessed an unquenchable thirst for adventure and an unparalleled ability to tell the stories of his life. "What Do You Care What Other People Think?" is Feynman's last literary legacy, prepared with his friend and fellow drummer, Ralph Leighton. Among its many tales—some funny, others intensely moving—we meet Feynman's first wife, Arlene, who taught him of love's irreducible mystery as she lay dying in a hospital bed while he worked nearby on the atomic bomb at Los Alamos. We are also given a fascinating narrative of the investigation of the space shuttle Challenger's explosion in 1986, and we relive the moment when Feynman revealed the disaster's cause by an elegant experiment: dropping a ring of rubber into a glass of cold water and pulling it out, misshapen.

This open access book chronicles the rise of a new scientific paradigm offering novel insights into the age-old enigmas of existence. Over 300 years ago, the human mind discovered the machine code of reality: mathematics. By utilizing abstract thought systems, humans began to decode the workings of the cosmos. From this understanding, the current scientific paradigm emerged, ultimately discovering the gift of technology. Today, however, our island of knowledge is surrounded by ever longer shores of ignorance. Science appears to have hit a dead end when confronted with the nature of reality and consciousness. In this fascinating and accessible volume, James Glattfelder explores a radical paradigm shift uncovering the ontology of reality. It is found to be information-theoretic and participatory, yielding a computational and programmable universe.

From Nobel Prize-winning physicist P. J. E. Peebles, the story of cosmology from Einstein to today Modern cosmology began a century ago with Albert Einstein's general theory of relativity and his notion of a homogenous, philosophically satisfying cosmos. Cosmology's Century is the story of how generations of scientists built on these thoughts and many new measurements to arrive at a well-tested physical theory of the structure and evolution of our expanding universe. In this landmark book, one of the world's most esteemed theoretical cosmologists offers an unparalleled personal perspective on how the field developed. P. J. E. Peebles was at the forefront of many of the greatest discoveries of the past century, making fundamental contributions to our understanding of the presence of helium and microwave radiation from the hot big bang, the measures of the distribution and motion of ordinary matter, and the new kind of dark matter that allows us to make sense of these results. Taking readers from the field's beginnings, Peebles describes how scientists working in independent directions found themselves converging on a theory of cosmic evolution interesting enough to warrant the rigorous testing it passes so well. He explores the major advances—some inspired by remarkable insights or perhaps just lucky guesses—as well as the wrong turns taken and the roads not explored. He shares recollections from major players in this story and provides a rare, inside look at how natural science is really done. A monumental work, Cosmology's Century also emphasizes where the present theory is incomplete, suggesting exciting directions for continuing research.

An annotated facsimile edition of Einstein's handwritten manuscript on the foundations of general relativity This richly annotated facsimile edition of "The Foundation of General Relativity" introduces a new generation of readers to Albert Einstein's theory of gravitation. Written in 1915, this remarkable document is a watershed in the history of physics and an enduring testament to the elegance and precision of Einstein's thought. Presented here is a beautiful facsimile of Einstein's original handwritten manuscript, along with its English translation and an insightful page-by-page commentary that places the work in historical and scientific context. Hanoch Gutfreund and Jürgen Renn's concise introduction traces Einstein's intellectual odyssey from special to general relativity, and their essay "The Charm of a Manuscript" provides a delightful meditation on the varied afterlife of Einstein's text. Featuring a foreword by John Stachel, this handsome edition also includes a biographical glossary of the figures discussed in the book, a comprehensive bibliography, suggestions for further reading, and numerous photos and illustrations throughout.

Einstein, Bohr and the Great Debate About the Nature of Reality

The Dispersion of Feynman Diagrams in Postwar Physics

Moments of Decision

The Formative Years of Relativity

An Overview of the New Physics

The History and Meaning of Einstein's "The Foundation of General Relativity", Featuring the Original Manuscript of Einstein's Masterpiece

Quantum Physics for Hippies

The Industrial Revolution meets the quantum-technology revolution! A steampunk adventure guide to how mind-blowing quantum physics is transforming our understanding of information and energy.

Victorian era steam engines and particle physics may seem worlds (as well as centuries) apart, yet a new branch of science, quantum thermodynamics, reenvisions the scientific underpinnings of the Industrial Revolution through the lens of today's roaring quantum information revolution. Classical thermodynamics, understood as the study of engines, energy, and efficiency, needs reimagining to take advantage of quantum mechanics, the basic framework that explores the nature of reality by peering at minute matters, down to the momentum of a single particle. In her exciting new book, intrepid Harvard-trained physicist Dr. Nicole Yunger Halpern introduces these concepts to the uninitiated with what she calls "quantum steampunk," after the fantastical genre that pairs futuristic technologies with Victorian sensibilities. While readers follow the adventures of a rag-tag steampunk crew on trains, dirigibles, and automobiles, they explore questions such as, "Can quantum physics revolutionize engines?" and "What deeper secrets can quantum information reveal about the trajectory of time?" Yunger Halpern also describes her own adventures in the quantum universe and provides an insider's look at the work of the scientists obsessed with its technological promise. Moving from fundamental physics to cutting-edge experimental applications, Quantum Steampunk explores the field's aesthetic, shares its whimsy, and gazes into the potential of a quantum future. The result is a blast for fans of science, science fiction, and fantasy.

This book tells the fascinating story of the people and events behind the turbulent changes in attitudes to quantum theory in the second half of the 20th century. The huge success of quantum mechanics as a predictive theory has been accompanied, from the very beginning, by doubts and controversy about its foundations and interpretation. This book looks in detail at how research on foundations evolved after WWII, when it was revived, until the mid 1990s, when most of this research merged into the technological promise of quantum information. It is the story of the quantum dissidents, the scientists who brought this subject from the margins of physics into its mainstream. It is also a history of concepts, experiments, and techniques, and of the relationships between physics and the world at large, touching on themes such as the Cold War, McCarthyism, Zhdanovism, and the unrest of the late 1960s.

Spacetime physics -- Physics in flat spacetime -- The mathematics of curved spacetime -- Einstein's geometric theory of gravity -- Relativistic stars -- The universe -- Gravitational collapse and black holes -- Gravitational waves -- Experimental tests of general relativity -- Frontiers

The assassination of President John F. Kennedy was an appalling and grisly conspiracy. In this unvarnished story, Kaiser shows that the events of November 22, 1963, cannot be understood without fully grasping the two larger stories of which they were a part: the U.S. government’s campaign against organized crime, which began in the late 1950s and accelerated dramatically under Robert Kennedy; and the furtive quest of two administrations to eliminate Fidel Castro. This book brings to light the complete, frequently shocking, story of the JFK assassination and its aftermath.

Winner of the 2007 Pfizer Prize from the History of Science Society. Feynman diagrams have revolutionized nearly every aspect of theoretical physics since the middle of the twentieth century. Introduced by the American physicist Richard Feynman (1918-88) soon after World War II as a means of simplifying lengthy calculations in quantum electrodynamics, they soon gained adherents in many branches of the discipline. Yet as new physicists adopted the tiny line drawings, they also adapted the diagrams and introduced their own interpretations. Drawing Theories Apart traces how generations of young theorists learned to frame their research in terms of the diagrams—and how both the diagrams and their users were molded in the process. Drawing on rich archival materials, interviews, and more than five hundred scientific articles from the period, Drawing Theories Apart uses the Feynman diagrams as a means to explore the development of American postwar physics. By focusing on the ways young physicists learned new calculational skills, David Kaiser frames his story around the crafting and stabilizing of the basic tools in the physicist's kit—thus offering the first book to follow the diagrams once they left Feynman's hands and entered the physics vernacular.

How Planck, Bohr, Einstein, and Heisenberg Taught Us to Love Uncertainty

Physics on the Fringe

How a New Understanding of the Universe Can Help Answer Age-Old Questions of Existence

Plastic Fantastic

Dance of the Photons

How the Hippies Saved Physics: Science, Counterculture, and the Quantum Revival

Cosmological Koans: A Journey to the Heart of Physical Reality

“The most exciting intellectual adventure I've been on since reading Robert Pirsig’s Zen and the Art of Motorcycle Maintenance.” —Christopher Lehmann-Haupt, New York Times Gary Zukav’s timeless, humorous, New York Times bestselling masterpiece, The Dancing Wu Li Masters, is arguably the most widely acclaimed introduction to quantum physics ever written. Scientific American raves: “Zukav is such a skilled expositor, with such an amiable style, that it is hard to imagine a layman who would not find his book enjoyable and informative.” Accessible, edifying, and endlessly entertaining, The Dancing Wu Li Masters is back in a beautiful new edition—and the doors to the fascinating, dazzling, remarkable world of quantum physics are opened to all once again, no previous mathematical or technical expertise required.

Describes how the early-20th-century discoveries in quantum physics found their way into today's modern

language and collective culture, appearing in everything from television shows and movies to coffee mugs and T-shirts to art forms like sculpture and prose. 20,000 first printing.

An eccentric comic about the central mystery of quantum mechanics Totally Random is a comic for the serious reader who wants to really understand the central mystery of quantum mechanics--entanglement: what it is, what it means, and what you can do with it. Measure two entangled particles separately, and the outcomes are totally random. But compare the outcomes, and the particles seem as if they are instantaneously influencing each other at a distance—even if they are light-years apart. This, in a nutshell, is entanglement, and if it seems weird, then this book is for you. Totally Random is a graphic experiential narrative that unpacks the deep and insidious significance of the curious correlation between entangled particles to deliver a gut-feel glimpse of a world that is not what it seems. See for yourself how entanglement has led some of the greatest thinkers of our time to talk about crazy-sounding stuff like faster-than-light signaling, many worlds, and cats that are both dead and alive. Find out why it remains one of science's most paradigm-shaking discoveries. Join Niels Bohr's therapy session with the likes of Einstein, Schrödinger, and other luminaries and let go of your commonsense notion of how the world works. Use your new understanding of entanglement to do the seemingly impossible, like beat the odds in the quantum casino, or quantum encrypt a message to evade the Sphinx's all-seeing eye. But look out, or you might just get teleported back to the beginning of the book! A fresh and subversive look at our quantum world with some seriously funny stuff, Totally Random delivers a real understanding of entanglement that will completely change the way you think about the nature of physical reality.

Did the Woodstock generation reject science—or re-create it? An “enthralling” study of a unique period in scientific history (New Scientist). Our general image of the youth of the late 1960s and early 1970s is one of hostility to things like missiles and mainframes and plastics—and an enthusiasm for alternative spirituality and getting “back to nature.” But this enlightening collection reveals that the stereotype is overly simplistic. In fact, there were diverse ways in which the era’s countercultures expressed enthusiasm for and involved themselves in science—of a certain type. Boomers and hippies sought a science that was both small-scale and big-picture, as exemplified by the annual workshops on quantum physics at the Esalen Institute in Big Sur, or Timothy Leary’s championing of space exploration as the ultimate “high.” Groovy Science explores the experimentation and eclecticism that marked countercultural science and technology during one of the most colorful periods of American history. “Demonstrate[s] that people and groups strongly ensconced in the counterculture also embraced science, albeit in untraditional and creative ways.”—Science “Each essay is a case history on how the hippies repurposed science and made it cool. For the academic historian, Groovy Science establishes the ‘deep mark on American culture’ made by the countercultural innovators. For the non-historian, the book reads as if it were infected by the hippies’ democratic intent: no jargon, few convoluted sentences, clear arguments and a sense of delight.”—Nature “In the late 1960s and 1970s, the mind-expanding modus operandi of the counterculture spread into the realm of science, and sh-t got wonderfully weird. Neurophysiologist John Lilly tried to talk with dolphins. Physicist Peter Phillips launched a parapsychology lab at Washington University. Princeton physicist Gerard O’Neill became an evangelist for space colonies. Groovy Science is a new book of essays about this heady time.”—Boing Boing

Grete Hermann (1901-1984) was a pupil of mathematical physicist Emmy Noether, follower and co-worker of neo-Kantian philosopher Leonard Nelson, and an important intellectual figure in post-war German social democracy. She is best known for her work on the philosophy of modern physics in the 1930s, some of which emerged from intense discussions with Heisenberg and Weizsäcker in Leipzig. Hermann’s aim was to counter the threat to the Kantian notion of causality coming from quantum mechanics. She also discussed in depth the question of ‘hidden variables’ (including the first critique of von Neumann’s alleged impossibility proof) and provided an extensive analysis of Bohr’s notion of complementarity. This volume includes translations of Hermann’s two most important essays on this topic: one hitherto unpublished and one translated here into English for the first time. It also brings together recent scholarly contributions by historians and philosophers of science, physicists, and philosophers and educators following in Hermann’s steps. Hermann's work places her in the first rank among philosophers who wrote about modern physics in the first half of the last century. Those interested in the many fields to which she contributed will find here a comprehensive discussion of her philosophy of physics that places it in the context of her wider work.

Through Two Doors at Once

The Hidden Life of Paul Dirac, Mystic of the Atom

The Physics of Yesterday's Tomorrow

Worlds Without End

The Road to Dallas

How the Biggest Fraud in Physics Shook the Scientific World

Their Lives, Struggles, and Momentous Discoveries: Second Edition

"Physicists have grappled with quantum theory for over a century. They have learned to wring precise answers from the theory's governing equations, and no experiment to date has found compelling evidence to contradict it. Even so, the conceptual apparatus remains stubbornly, famously bizarre. Physicists have tackled these conceptual uncertainties while navigating still larger ones: the rise of fascism, cataclysmic world wars and a new nuclear age, an unsteady Cold War stand-off and its unexpected end. Quantum Legacies introduces readers to physics' still-unfolding quest by treating iconic moments of discovery and debate among well-known figures like Albert Einstein, Erwin Schrödinger, and Stephen Hawking, and many others whose contributions have indelibly shaped our understanding of nature"--

Traces the infamous fraudulent discovery of physicist Jan Henrik Schön, a star researcher from Bell Laboratories who claimed to have developed technology that would enable the creation of virtually limitless computer chips, in an account that evaluates the motivations for his scam and how it successfully duped some of the scientific community's most informed minds.

The evolution of MIT, as seen in a series of crucial decisions over the years. How did MIT become MIT? The Massachusetts Institute of Technology marks the 150th anniversary of its founding in 2011. Over the years, MIT has lived by its motto, “Mens et Manus” (“Mind and Hand”), dedicating itself to the pursuit of knowledge and its application to real-

world problems. MIT has produced leading scholars in fields ranging from aeronautics to economics, invented entire academic disciplines, and transformed ideas into market-ready devices. This book examines a series of turning points, crucial decisions that helped define MIT. Many of these issues have relevance today: the moral implications of defense contracts, the optimal balance between government funding and private investment, and the right combination of basic science, engineering, and humanistic scholarship in the curriculum. Chapters describe the educational vison and fund-raising acumen of founder William Barton Rogers (MIT was among the earliest recipients of land grant funding); MIT's relationship with Harvard—its rival, doppelgänger, and, for a brief moment, degree-conferring partner; the battle between pure science and industrial sponsorship in the early twentieth century; MIT's rapid expansion during World War II because of defense work and military training courses; the conflict between Cold War gadgetry and the humanities; protests over defense contracts at the height of the Vietnam War; the uproar in the local community over the perceived riskiness of recombinant DNA research; and the measures taken to reverse years of institutionalized discrimination against women scientists.

In The Quantum Universe, Brian Cox and Jeff Forshaw approach the world of quantum mechanics in the same way they did in Why Does E=mc2? and make fundamental scientific principles accessible—and fascinating—to everyone. The subatomic realm has a reputation for weirdness, spawning any number of profound misunderstandings, journeys into Eastern mysticism, and woolly pronouncements on the interconnectedness of all things. Cox and Forshaw’s contention? There is no need for quantum mechanics to be viewed this way. There is a lot of mileage in the “weirdness” of the quantum world, and it often leads to confusion and, frankly, bad science. The Quantum Universe cuts through the Wu Li and asks what observations of the natural world made it necessary, how it was constructed, and why we are confident that, for all its apparent strangeness, it is a good theory. The quantum mechanics of The Quantum Universe provide a concrete model of nature that is comparable in its essence to Newton’s laws of motion, Maxwell’s theory of electricity and magnetism, and Einstein’s theory of relativity.

The twentieth century was one of astonishing change in science, especially as pursued in the United States. Against a backdrop of dramatic political and economic shifts brought by world wars, intermittent depressions, sporadic and occasionally massive increases in funding, and expanding private patronage, this scientific work fundamentally reshaped everyday life. Science and the American Century offers some of the most significant contributions to the study of the history of science, technology, and medicine during the twentieth century, all drawn from the pages of the journal Isis. Fourteen essays from leading scholars are grouped into three sections, each presented in roughly chronological order. The first section charts several ways in which our knowledge of nature was cultivated, revealing how scientific practitioners and the public alike grappled with definitions of the “natural” as they absorbed and refracted global information. The essays in the second section investigate the changing attitudes and fortunes of scientists during and after World War II. The final section documents the intricate ways that science, as it advanced, became intertwined with social policies and the law. This important and useful book provides a thoughtful and detailed overview for scholars and students of American history and the history of science, as well as for scientists and others who want to better understand modern science and science in America.

A Brief Tour of a Weighty Subject

Knowledge, Innovation, and American Counterculture

Discovering Your Inner Scientist

Dispatches from an Uncertain World

The Quantum Moment

Groovy Science

How the Hippies Saved Physics

Today, quantum information theory is among the most exciting scientific frontiers, attracting billions of dollars in funding and thousands of talented researchers. But as MIT physicist and historian David Kaiser reveals, this cutting-edge field has a surprisingly psychedelic past. How the Hippies Saved Physics introduces us to a band of freewheeling physicists who defied the imperative to "shut up and calculate" and helped to rejuvenate modern physics. For physicists, the 1970s were a time of stagnation. Jobs became scarce, and conformity was encouraged, sometimes stifling exploration of the mysteries of the physical world. Dissatisfied, underemployed, and eternally curious, an eccentric group of physicists in Berkeley, California, banded together to throw off the constraints of the physics mainstream and explore the wilder side of science. Dubbing themselves the "Fundamental Fysiks Group," they pursued an audacious, speculative approach to physics. They studied quantum entanglement and Bell's Theorem through the lens of Eastern mysticism and psychic mind-reading, discussing the latest research while lounging in hot tubs. Some even dabbled with LSD to enhance their creativity. Unlikely as it may seem, these iconoclasts spun modern physics in a new direction, forcing mainstream physicists to pay attention to the strange but exciting underpinnings of quantum theory. A lively, entertaining story that illuminates the relationship between creativity and scientific progress, How the Hippies Saved Physics takes us to a time when only the unlikeliest heroes could break the science world out of its rut.

Gravitation

Trespassing on Einstein's Lawn

Science and the American Century

On Gravity

Totally Random

Readings from "Isis"

An Inside History of Our Modern Understanding of the Universe