Uncertainty Einstein Heisenberg Bohr And The Struggle For The Soul Of Science
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The Age of Entanglement
This is a fascinating account of two great scientists of the 20th century: Einstein and Heisenberg, discoverers, respectively, of the theory of relativity and quantum mechanics. It connects the history of modern physics to the life stories of these two extraordinary physicists. These discoveries laid the foundation of modern physics, without which our digitized world of computers, satellites, and innovative materials would not be possible. This book also describes in comprehensible terms the complicated science underlying the two discoveries. The twin biography highlights the parallels and differences of these two luminaries, showing how their work shaped the 20th century into the century of physics.

The Big Picture

Einstein and the Quantum
‘Fascinating’ - Brian Cox, Mail on Sunday Books of the Year Where are we? Who are we? Do our beliefs, hopes and dreams hold any significance out there in the void? Can human purpose and meaning ever fit into a scientific worldview? Award-winning author Sean Carroll brings his extraordinary intellect to bear on the realms of knowledge, the laws of nature and the most profound questions about life, death and our place in it all. From Darwin and Einstein to the origins of life, consciousness and the universe itself, Carroll combines cosmos-sprawling science and profound thought in a quest to explain our world. Destined to sit alongside the works of our greatest thinkers, The Big Picture demonstrates that while our lives may be forever dwarfed by the immensity of the universe, they can be redeemed by our capacity to comprehend it and give it meaning.

Niels Bohr: Physics and the World
‘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.

**The Quantum Challenge**

"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.

**100 Years Werner Heisenberg**

“What Bodanis does brilliantly is to give us a feel for Einstein as a person. I don’t think I’ve ever read a book that does this as well” (Popular Science). In this “fascinating” biography, the acclaimed author of E=mc² reveals that in spite of his indiscutable brilliance, Albert Einstein found himself ignored by most working scientists during the final decades of his life, his ideas opposed by even his closest friends (Forbes). How did this happen? Einstein revolutionized our understanding of the cosmos with his general theory of relativity, and helped lead us into the atomic age. This book goes beyond his remarkable intellect and accomplishments to examine the man himself, from the skeptical, erratic student to the world’s greatest physicist to the fallen-from-grace celebrity. An intimate biography that “imparts fresh insight into the genius—and failures—of the 20th century’s most celebrated scientist,” Einstein's Greatest Mistake reveals what we owe Einstein today—and how much more he might have achieved if not for his all-too-human flaws (Publishers Weekly). Named a Science Book of the Year by the Sunday Times and one of the Top Five Science Books of 2016 by ABC News Australia, this unique book “offers a window onto Einstein’s achievements and missteps, as well as his life—his friendships, his complicated love life (two marriages, many affairs) and his isolation from other scientists at the end of his life” (BookPage).

**Einstein’s Struggles with Quantum Theory**

The gripping, entertaining, and vividly-told narrative of a radical discovery that sent shockwaves through the scientific community and forever changed the way we understand the world. Werner Heisenberg’s “uncertainty principle” challenged centuries of scientific understanding, placed him in direct opposition to Albert Einstein, and put Niels Bohr in the middle of one of the most heated debates in scientific history. Heisenberg’s theorem stated that there were physical limits to what we could know about sub-atomic particles; this “uncertainty” would have shocking implications. In a riveting and lively account, David Lindley captures this critical episode and explains one of the most important scientific discoveries in history, which has since transcended the boundaries of science and influenced everything from literary theory to television.

**Uncommon Wisdom**

This book offers an exploration of the relationships between epistemology and probability in the work of Niels Bohr, Werner Heisenberg, and Erwin Schro¨dinger, and in quantum mechanics and in modern physics as a whole. It also considers the implications of these relationships and of quantum theory itself for our understanding of the nature of human thinking and knowledge in general, or the “epistemological lesson of quantum mechanics,” as Bohr liked 1 to say. These implications are radical and controversial. While they have been seen as scientifically productive and intellectually liberating to some, Bohr and Heisenberg among them, they have been troublesome to many others, such as Schro¨dinger and, most prominently, Albert Einstein. Einstein famously refused to believe that God would resort to playing dice or rather to playing with nature in the way quantum mechanics appeared to suggest, which is indeed quite different from playing dice. According to his later (sometime around 1953) remark, a lesser known or commented upon but arguably more important one: “That the Lord should play [dice], all right; but that He should gamble according to definite rules [i.e., according to the rules of quantum
mechanics, rather than 2 by merely throwing dice], that is beyond me. ” Although Einstein's 
invocation of God is taken literally sometimes, he was not talking about God but about the way 
nature works. Bohr’s reply on an earlier occasion to Einstein’s question 1 Cf.

Einstein, Physics and Reality

Grete Hermann - Between Physics and Philosophy

'A monumental achievement - one of the great scientific biographies.' Michael Frayn The
Strangest Man is the Costa Biography Award-winning account of Paul Dirac, the famous 
physicist sometimes called the British Einstein. He was one of the leading pioneers of the 
greatest revolution in twentieth-century science: quantum mechanics. The youngest theoretician 
ever to win the Nobel Prize for Physics, he was also pathologically reticent, strangely literal-
minded and legendarily unable to communicate or empathize. Through his greatest period of 
productivity, his postcards home contained only remarks about the weather. Based on a 
previously undiscovered archive of family papers, Graham Farmelo celebrates Dirac's massive 
scientific achievement while drawing a compassionate portrait of his life and work. Farmelo 
shows a man who, while hopelessly socially inept, could manage to love and sustain close 
friendship. The Strangest Man is an extraordinary and moving human story, as well as a study of 
one of the most exciting times in scientific history. ‘A wonderful book . . . Moving, sometimes 
comic, sometimes infinitely sad, and goes to the roots of what we mean by truth in science.’ Lord 
Waldegrave, Daily Telegraph

The Island of Knowledge

Why discovering the limits to science may be the most powerful discovery of all How much can 
we know about the world? In this book, physicist Marcelo Gleiser traces our search for answers 
to the most fundamental questions of existence, the origin of the universe, the nature of reality, 
and the limits of knowledge. In so doing, he reaches a provocative conclusion: science, like 
religion, is fundamentally limited as a tool for understanding the world. As science and its 
philosophical interpretations advance, we face the unsettling recognition of how much we don't 
know. Gleiser shows that by abandoning the dualistic model that divides reality into the known 
and the unknown, we can embark on a third way based on the acceptance of our limitations. Only 
then, he argues, will we be truly able to experience freedom; for to be free in an age of science 
we cannot turn science into a god. Gleiser ultimately offers an uplifting exploration of 
humanity's longing to conquer the unknown, and of science's power to transform and inspire.

Encounters with Einstein

The 1927 Solvay conference was perhaps the most important in the history of quantum theory. 
Contrary to popular belief, questions of interpretation were not settled at this conference.
Instead, a range of sharply conflicting views were extensively discussed, including de Broglie's 
pilot-wave theory (which de Broglie presented for a many-body system), Born and Heisenberg's 
'quantum mechanics' (which apparently lacked wave function collapse or fundamental time 
evolution), and Schrödinger's wave mechanics. Today, there is no longer a dominant 
interpretation of quantum theory, so it is important to re-evaluate the historical sources and 
keep the debate open. This book contains a complete translation of the original proceedings, 
with essays on the three main interpretations presented, and a detailed analysis of the lectures 
and discussions in the light of current research. This book will be of interest to graduate 
students and researchers in physics and in the history and philosophy of quantum theory.

Where Does The Weirdness Go?

Few revolutions in science have been more far-reaching--but less understood--than the quantum 
revolution in physics. Everyday experience cannot prepare us for the sub-atomic world, where 
quantum effects become all-important. Here, particles can look like waves, and vice versa; 
electrons seem to lose their identity and instead take on a shifting, unpredictable appearance 
that depends on how they are being observed; and a single photon may sometimes behave as if it 
could be in two places at once. In the world of quantum mechanics, uncertainty and ambiguity 
become not just unavoidable, but essential ingredients of science--a development so disturbing 
that to Einstein "it was as if God were playing dice with the universe." And there is no one better 
able to explain the quantum revolution as it approaches the century mark than David Lindley. He 
brings the quantum revolution full circle, showing how the familiar and trustworthy reality of 
the world around us is actually a consequence of the ineffable uncertainty of the subatomic 
quartum world--the world we can't see.
“I find the idea quite intolerable that an electron exposed to radiation should choose of its own free will, not only its moment to jump off, but also its direction. In that case, I would rather be a cobbler, or even an employee in a gaming house, than a physicist.” -Albert Einstein

A scandal hovers over the history of 20th century physics. Albert Einstein -- the century's greatest physicist -- was never able to come to terms with quantum mechanics, the century's greatest theoretical achievement. For physicists who routinely use both quantum laws and Einstein's ideas, this contradiction can be almost too embarrassing to dwell on. Yet Einstein was one of the founders of quantum physics and he spent many years preaching the quantum's importance and its revolutionary nature. The Danish genius Niels Bohr was another founder of quantum physics. He had managed to solve one of the few physics problems that Einstein ever shied away from, linking quantum mathematics with a new model of the atom. This leap immediately yielded results that explained electron behavior and the periodic table of the elements. Despite their mutual appreciation of the quantum's importance, these two giants of modern physics never agreed on the fundamentals of their work. In fact, they clashed repeatedly throughout the 1920s, arguing first over Einstein's theory of “light quanta” (photons), then over Niels Bohr's short-lived theory that denied the conservation of energy at the quantum level, and climactically over the new quantum mechanics that Bohr enthusiastically embraced and Einstein stubbornly defied. This contest of visions stripped the scientific imagination naked. Einstein was a staunch realist, demanding to know the physical reasons behind physical events. At odds with this approach was Bohr's more pragmatic perspective that favored theories that worked, even if he might not have a corresponding explanation of the underlying reality. Powerful and illuminating, Einstein Defiant is the first book to capture the soul and the science that inspired this dramatic duel, revealing the personalities and the passions -- and, in the end, what was at stake for the world.

Physics and Beyond

Containing the proceedings of the symposium held by the American Academy of Arts and Sciences to celebrate the 100th anniversary of the birth of Niels Bohr, this collection was first published in 1988. More than any other individual, Bohr was responsible for the development of quantum mechanics and for many of its applications in the pursuit of fundamental understanding of physical reality. In addition to his unique role in the discovery and elucidation of quantum theory, Bohr led the study of the fission of nuclei and was greatly concerned with the impact of the existence of the atomic bomb in the post-World War II era. This unique volume provides a panoramic view of modern physics, some of the philosophical issues associated with quantum theory, the impact of this momentous scientific development on the political circumstance of the Cold War Era and the qualities of a superlative scientist.

Quantum Theory at the Crossroads

"Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb is an excellent work of scholarship and makes Heisenberg's work and life accessible to the general reader, while remaining important and interesting for the historian and scientist. Along with Wernher von Braun, Heisenberg's career under Hitler represents perhaps the best twentieth-century example of a faustian bargain with evil for the advancement of knowledge and science. Cassidy tells this story with nuance and passion."--Mark Walker, author of Nazi Science: Myth, Truth, and the German Atomic Bomb In 1992, David C. Cassidy's groundbreaking biography of Werner Heisenberg, Uncertainty, was published to resounding acclaim from scholars and critics. Michael Frayn, in the Playbill of the Broadway production of Copenhagen, referred to it as one of his sources and "the standard work in English." Richard Rhodes (The Making of the Atom Bomb) called it "the definitive biography of a great and tragic physicist," and the Los Angeles Times praised it as "an important book. Cassidy has sifted the record and brilliantly detailed Heisenberg's actions." No book that has appeared since has rivaled Uncertainty, now out of print, for its depth and rich detail of the life, times, and science of this brilliant and controversial figure of twentieth-century physics. Since the fall of the Soviet Union, long-suppressed information has emerged on Heisenberg's role in the Nazi atomic bomb project. In Beyond Uncertainty, Cassidy interprets this and other previously unknown material within the context of his vast research and tackles the vexing questions of a scientist's personal responsibility and guilt when serving an abhorrent military regime. David C. Cassidy is the author of J. Robert Oppenheimer and the American Century, Einstein and Our World, and Uncertainty. Professor of natural sciences at Hofstra University, he has served as associate editor of The Collected Papers of Albert Einstein. He is the only author to have received both the Science Writing Award from the American Institute of Physics and the Pfizer Award from the History of Science Society for the same book (Uncertainty).
Introducing Quantum Theory

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.

Quantum

Quantum physics, quantum theory.

The Physical Principles of the Quantum Theory

Beyond Uncertainty

This invaluable book takes the reader from Planck's discovery of the quantum in 1900 to the most recent interpretations and applications of nonrelativistic quantum mechanics. The introduction of the quantum idea leads off the prehistory of quantum mechanics, featuring Planck, Einstein, Bohr, Compton, and de Broglie's immortal contributions. Their original discovery papers are featured with explanatory notes and developments in Part 1. The invention of matrix mechanics and quantum mechanics by Heisenberg, Born, Jordan, Dirac, and Schrödinger is presented next, in Part 2. Following that, in Part 3, are the Einstein-Bohr debates on the interpretation of quantum mechanics culminating in Bell's inequality and Aspect's experiment demonstrating the actuality of the long range quantum correlations to which Einstein, Podolsky, and Rosen took great exception. Resolutions of quantum paradoxes and the current state of such debates are summarized. Part 4 presents a selection of the most dramatic modern developments, both theoretical and experimental. These include Feynman path integrals, the modern interpretation based on decoherence, quantum optics experiments leading to teleportation, DeWitt’s wave function of the universe, and a brief introduction to the end-of-the-millennium prospects of quantum computation. A concluding chapter presents the authors' conjectures for the next 100 years of the quantum. This book is ideally suited to anyone with a junior level background in modern physics and quantum mechanics, and a cultural interest in the original sources of the greatest ideas of the greatest founders of this subject as derived from their first discovery papers. These papers have led, in giant strides across the whole of the twentieth century, to the revolutionary experimental advances of the last decade. The book makes accessible — physically and intellectually — both the deepest roots and the highest branches of nonrelativistic quantum physics. Contents: Part One: Planck Invents the Quantum

Einstein and Compton

Bohr’s Hydrogen Atom

de Broglie Waves

Kramers and Heisenberg

Part Two: Heisenberg Invents Quantum Dynamics

Born, Heisenberg and Jordan

Dirac's Quantum Mechanics

Schrödinger's Wave Mechanics

Part Three: Born's Interpretation

Heisenberg's Uncertainty Principle

Einstein, Podolsky, and Rosen

Part Four: Bohm and Bell, Clauser and Aspect

Feynman Path Integral

Hartle's Interpretation

DeWitt's Wave Function of the Universe

Deutsch's Quantum Computer

The Next 100 Years

Readership: Students and researchers in quantum mechanics.

Keywords: Reviews: “When you have finished the book, you will have read parts of some papers that you probably would not have otherwise read, and you will have been given a guided tour through confusing territory by some wise and knowing guides.” Physics Today

Beyond Uncertainty

Quantum theory confronts us with bizarre paradoxes which contradict the logic of classical physics. At the subatomic level, one particle seems to know what the others are doing, and according to Heisenberg’s “uncertainty principle”, there is a limit on how accurately nature can be observed. And yet the theory is amazingly accurate and widely applied, explaining all of
chemistry and most of physics. "Introducing Quantum Theory" takes us on a step-by-step tour with the key figures, including Planck, Einstein, Bohr, Heisenberg and Schrödinger. Each contributed at least one crucial concept to the theory. The puzzle of the wave-particle duality is here, along with descriptions of the two questions raised against Bohr's "Copenhagen Interpretation" - the famous "dead and alive cat" and the EPR paradox. Both remain unresolved.

**Einstein Defiant**

In 1900 many eminent scientists did not believe atoms existed, yet within just a few years the atomic century launched into history with an astonishing string of breakthroughs in physics that began with Albert Einstein and continues to this day. Before this explosive growth into the modern age took place, an all-but-forgotten genius strove for forty years to win acceptance for the atomic theory of matter and an altogether new way of doing physics. Ludwig Boltzmann battled with philosophers, the scientific establishment, and his own potent demons. His victory led the way to the greatest scientific achievements of the twentieth century. Now acclaimed science writer David Lindley portrays the dramatic story of Boltzmann and his embrace of the atom, while providing a window on the civilized world that gave birth to our scientific era. Boltzmann emerges as an endearingly quixotic character, passionately inspired by Beethoven, who muddled through the practical matters of life in a European gilded age. Boltzmann's story reaches from fin de siècle Vienna, across Germany and Britain, to America. As the Habsburg Empire was crumbling, Germany's intellectual might was growing; Edinburgh in Scotland was one of the most intellectually fertile places on earth; and, in America, brilliant independent minds were beginning to draw on the best ideas of the bureaucratized old world. Boltzmann's nemesis in the field of theoretical physics at home in Austria was Ernst Mach, noted today in the term Mach I, the speed of sound. Mach believed physics should address only that which could be directly observed. How could we know that frisky atoms jiggling about corresponded to heat if we couldn't see them? Why should we bother with theories that only told us what would probably happen, rather than making an absolute prediction? Mach and Boltzmann both believed in the power of science, but their approaches to physics could not have been more opposed. Boltzmann sought to explain the real world, and cast aside any philosophical criteria. Mach, along with many nineteenth-century scientists, wanted to construct an empirical edifice of absolute truths that obeyed strict philosophical rules. Boltzmann did not get on well with authority in any form, and he did his best work at arm's length from it. When at the end of his career he engaged with the philosophical authorities in the Viennese academy, the results were personally disastrous and tragic. Yet Boltzmann's enduring legacy lives on in the new physics and technology of our wired world. Lindley's elegant telling of this tale combines the detailed breadth of the best history, the beauty of theoretical physics, and the psychological insight belonging to the finest of novels.

**Einstein's Greatest Mistake**

An explosive re-imagining of the mysterious wartime meeting between two Nobel laureates to discuss the atomic bomb.

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

Synopsis coming soon.

**The Quantum Moment: How Planck, Bohr, Einstein, and Heisenberg Taught Us to Love Uncertainty**

Werner Heisenberg's genius and his place at the forefront of modern physics are unquestioned. His decision to remain in Germany throughout the Third Reich and his role in Hitler's atomic bomb project are still topics of heated debate. UNCERTAINTY is David Cassidy's compelling portrait of this brilliant, ambitious, and controversial scientist. It is the definitive Heisenberg biography, as well as a striking evocation of the development of quantum physics, the rise of Nazism, and the dawn of the atomic age.

**Uncertainty**

"A very fun way to learn about where quantum physics comes from and the strange, even astonishing places it has gone." —Peter Galison, Harvard University, author of Einstein's Clocks, Poincaré's Maps From multiverses and quantum leaps to Schrödinger's cat and time travel, quantum mechanics has irreversibly shaped the popular imagination. Entertainers and writers
from Lady Gaga to David Foster Wallace take advantage of its associations and nuances. In The Quantum Moment, philosopher Robert P. Crease and physicist Alfred Scharff Goldhaber recount the fascinating story of how the quantum jumped from physics into popular culture, with brief explorations of the underlying math and physics concepts and descriptions of the fiery disputes among figures including Einstein, Schrödinger, and Niels Bohr. Understanding and appreciating quantum imagery, its uses and abuses, is part of what it means to be an educated person in the twenty-first century. The Quantum Moment serves as an indispensable guide.

**Niels Bohr's Philosophy of Physics**

In The Age of Entanglement, Louisa Gilder brings to life one of the pivotal debates in twentieth century physics. In 1935, Albert Einstein famously showed that, according to the quantum theory, separated particles could act as if intimately connected—a phenomenon which he derisively described as “spooky action at a distance.” In that same year, Erwin Schrödinger christened this correlation “entanglement.” Yet its existence was mostly ignored until 1964, when the Irish physicist John Bell demonstrated just how strange this entanglement really was. Drawing on the papers, letters, and memoirs of the twentieth century's greatest physicists, Gilder both humanizes and dramatizes the story by employing the scientists’ own words in imagined face-to-face dialogues. The result is a richly illuminating exploration of one of the most exciting concepts of quantum physics.

**Faust In Copenhagen**

"Exhaustively detailed yet eminently readable, this is an important book."Publishers Weekly, starred review "Cassidy does not so much exculpate Heisenberg as explain him, with a transparency that makes this biography a pleasure to read."Los Angeles Times "Well crafted and readable . . . [Cassidy] provides a nuanced and compelling account of Heisenberg's life."The Harvard Book Review In 1992, David C. Cassidy's groundbreaking biography of Werner Heisenberg, Uncertainty, was published to resounding acclaim from scholars and critics. Michael Frayn, in the Playbill of the Broadway production of Copenhagen, referred to it as one of his main sources and “the standard work in English.” Richard Rhodes (The Making of the Atom Bomb) called it “the definitive biography of a great and tragic physicist,” and the Los Angeles Times praised it as “an important book. Cassidy has sifted the record and brilliantly detailed Heisenberg's actions.” No book that has appeared since has rivaled Uncertainty, now out of print, for its depth and rich detail of the life, times, and science of this brilliant and controversial figure of twentieth-century physics. Since the fall of the Soviet Union, long-suppressed information has emerged on Heisenberg's role in the Nazi atomic bomb project. In Beyond Uncertainty, Cassidy interprets this and other previously unknown material within the context of his vast research and tackles the vexing questions of a scientist's personal responsibility and guilt when serving an abhorrent military regime. David C. Cassidy is the author of J. Robert Oppenheimer and the American Century, Einstein and Our World, and Uncertainty.

**The Quantum Cookbook**

The book combines popular and textbook presentation. It aims not to teach readers how to do quantum mechanics but rather helps them understand how to think about quantum mechanics. The real source of confusion in quantum mechanics does not originate in the mathematics, but in our understanding of what a scientific theory is supposed to represent.

**100 Years of Planck's Quantum**

Essays discuss the philosophy of science, quantum mechanics, cosmic radiation, elementary particles, and closed theories

**Uncertainty**

The Quantum Challenge, Second Edition, is an engaging and thorough treatment of the extraordinary phenomena of quantum mechanics and of the enormous challenge they present to our conception of the physical world. Traditionally, the thrill of grappling with such issues is reserved for practicing scientists, while physical science, mathematics, and engineering students are often isolated from these inspiring questions. This book was written to remove this isolation.

**How to Teach Physics to Your Dog**

This book presents an account of all aspects of Einstein's achievements in quantum theory, his
own views, and the progress his work has stimulated since his death. While some chapters use mathematics at an undergraduate physics level, a path is provided for the reader more concerned with ideas than equations, and the book will benefit to anybody interested in Einstein and his approach to the quantum.

**The Strangest Man**

Original publication and copyright date: 2009.

**Quantum Weirdness: Einstein vs. Bohr**

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.

**The Quantum Universe**

Over 40 renowned scientists from all around the world discuss the work and influence of Werner Heisenberg. The papers result from the symposium held by the Alexander von Humboldt-Stiftung on the occasion of the 100th anniversary of Heisenberg's birth, one of the most important physicists of the 20th century and cofounder of modern-day quantum mechanics. Taking atomic and laser physics as their starting point, the scientists illustrate the impact of Heisenberg's theories on astroparticle physics, high-energy physics and string theory right up to processing quantum information.

**Einstein and Heisenberg**

This book gives a clear and comprehensive exposition of Niels Bohr's philosophy of physics. Bohr's ideas are of major importance, for they are the source of the Copenhagen interpretation of quantum physics; yet they are obscure, and call for the sort of close analysis that this book provides. The book describes the historical background of the physics from which Bohr's ideas grew. The core of the book is a detailed analysis of Bohr's arguments for complementarity and of the interpretation which he put upon it. Special emphasis is placed throughout on the contrasting views of Einstein, and the great debate between Bohr and Einstein is thoroughly examined. The book traces the philosophical influences on Bohr, and unravels the realist and anti-realist strands in his thinking. Bohr's philosophy is critically assessed in the light of recent developments in the foundations of quantum physics (the work of Bell and others) and in philosophy (the realism-anti-realism debate) and it is revealed as being much more subtle and sophisticated than it is generally taken to be. While the book will be of interest to specialists, it is written in a style that will make it accessible to those who have no specialist knowledge of the relevant physics and philosophy.

**Copenhagen**

In 1932, the so-called annus mirabilis of modern physics, a group of scientists gathered in Copenhagen for a week-long conference on the extraordinary new work that was taking place in laboratories across the world; work that would ultimately lead to the development of nuclear weapons and the ensuing international power struggles. Segrè's erudite and impressive account explores this crucial moment in history through the lives and careers of seven physicists sitting in the front row of the Copenhagen meeting. Six of them were already in the pantheon of genius while the seventh - Max Delbrück - was the author of a skit performed at the conference that lightly parodied the struggle between the old and new theories of physics and eerily foreshadowed the events that were to unfold in the struggle between peaceful uses of scientific discovery and destructive ones.
The Quantum World

An in-depth analysis of the uncertainty principle, first introduced by German physicist Werner Heisenberg in 1927, discusses the birth, evolution, and impact of this important idea, as well as the clash in personalities and ideas that it provoked between Einstein's theories and the new generations of physicists who espoused quantum theory. Reprint. 20,000 first printing.

Epistemology and Probability

The Quantum Universe brings together two authors on a brilliantly ambitious mission to show that everyone can understand the deepest questions of science. But just what is quantum physics? How does it help us understand the world? Where does it leave Newton and Einstein? And why, above all, can we be sure that the theory is good? The bizarre behaviour of the atoms and energy that make up the universe has led to some very woolly pronouncements on the nature of all interconnectedness. Here, Brian Cox and Jeff Forshaw give us the real science, and reveal the profound theories that allow for concrete, yet astonishing, predictions about the world. This is our most up-to-date picture of reality.

Uncertainty

Albert Einstein was one of the principal founders of the quantum and relativity theories. Until 1925, when Bose-Einstein statistics was discovered, he made great contributions to the foundations of quantum theory. However, after the discovery of quantum mechanics by Heisenberg and wave mechanics by Schrödinger, with the consequent development of the principles of uncertainty and complementarity, it would seem that Einstein's views completely changed. In his theory of the Brownian motion, Einstein had invoked the theory of probability to establish the reality of atoms and molecules; but, in 1916-17, when he wished to predict the exact instant when an atom would radiate -- and developed his theory of the A and B coefficients -- "a statistical residue remained," which he did not quite have the courage of his convictions to accept, as he told his friend Max Born. However, he wrote later to Born that quantum mechanics "is certainly imposing," but "an inner voice tells me that it is not the real thing It does, not bring us closer to the secret of the 'Old One'. I, at any rate, am convinced that He is not playing at dice." At the 1927 and 1930 Solvay Conferences on Physics in Brussels, Einstein engaged in profound discussions with Niels Bohr and others about his conviction regarding classical determinism versus the statistical causality of quantum mechanics. To the end of his life he retained his belief in a deterministic philosophy. This highly interesting book explores Einstein's views on the nature and structure of physics and reality.

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