Quantum Einstein Bohr And The Great Debate About The Nature Of Reality

The Quantum Moment
Niels Bohr's Times
The Old Quantum Theory
Its Foundation and the Rise of Its Difficulties, 1900-1925
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A Path Across Life, the Universe and Everything
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Uncertainty
The Bohr Model of Atomic Structure 1913-1925
Niels Bohr's 1913 Trilogy Revisited
The Historical Development of Quantum Theory
Niels Bohr and the Quantum Atom
The Quantum Theory of Planck, Einstein, Bohr, and Sommerfeld
The Search for What Lies Beyond the Quantum
A Struggle for the Soul of Physics
The Epic Quest to Understand the Quantum Nature of Cause and Effect

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The Quantum Moment Basic Books
This book recalls, for nonscientific readers, the history of quantum mechanics, the main points of its interpretation, and Einstein's objections to it, together with the responses engendered by his arguments. Most popular discussions on the strange aspects of quantum mechanics ignore the fundamental fact that Einstein was correct in his insistence that the theory does not directly describe reality. While that fact does not remove the theory's counterintuitive features, it casts them in a different light. Context is provided by following the history of two central aspects of physics: the elucidation of the basic structure of the world made up of particles, and the explanation, as well as the prediction, of how objects move. This history, prior to quantum mechanics, reveals that whereas theories and discoveries concerning the "structure" of nature became increasingly realistic, the laws of motion, even as they became more powerful, became more and more abstract and remote from intuitive notions of reality. Newton's laws of motion gained their abstract power by sacrificing direct and intuitive contact with real experience. Arriving 250 years after Newton, the break with a direct description of reality embodied in quantum mechanics was nevertheless profound.Contents: Some Quantum HistoryRules and InterpretationsEinstein's DefectionFrom Atomism to Real ParticlesLaws of MotionFieldsNew Particles and Their Quantum OriginsAtoms, Inside and OutMethods and Underpinnings Readership: Academics and students in physics and the general public.
Niels Bohr's Times Icon Books Ltd
"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.
The Old Quantum Theory Penguin
A daring new vision of quantum theory from one of the leading minds of contemporary physics Quantum physics is the golden child of modern science. It is the basis of our understanding of atoms, radiation, and so much else, from elementary particles and basic forces to the behavior of materials. But for a century it has also been the problem child of science: it has been plagued by intense disagreements between its inventors, strange paradoxes, and implications that seem like the stuff of fantasy. Whether it's Schrödinger's cat--a creature that is simultaneously dead and

alive--or a belief that the world does not exist independently of our observations of it, quantum theory challenges our fundamental assumptions about reality. In Einstein's Unfinished Revolution, theoretical physicist Lee Smolin provocatively argues that the problems which have bedeviled quantum physics since its inception are unsolved and unsolvable, for the simple reason that the theory is incomplete. There is more to quantum physics, waiting to be discovered. Our task--if we are to have simple answers to our simple questions about the universe we live in--must be to go beyond quantum mechanics to a description of the world on an atomic scale that makes sense. In this vibrant and accessible book, Smolin takes us on a journey through the basics of quantum physics, introducing the stories of the experiments and figures that have transformed our understanding of the universe, before wrestling with the puzzles and conundrums that the quantum world presents. Along the way, he illuminates the existing theories that might solve these problems, guiding us towards a vision of the quantum that embraces common sense realism. If we are to have any hope of completing the revolution that Einstein began nearly a century ago, we must go beyond quantum mechanics to find a theory that will give us a complete description of nature. In Einstein's Unfinished Revolution, Lee Smolin brings us a step closer to resolving one of the greatest scientific controversies of our age.

Its Foundation and the Rise of Its Difficulties, 1900-1925 OUP Oxford

“Anyone who is not shocked by quantum theory has not understood it.” Since Niels Bohr said this many years ago, quantum mechanics has only been getting more shocking. We now realize that it’s not really telling us that “weird” things happen out of sight, on the tiniest level, in the atomic world: rather, everything is quantum. But if quantum mechanics is correct, what seems obvious and right in our everyday world is built on foundations that don’t seem obvious or right at all—or even possible. An exhilarating tour of the contemporary quantum landscape, Beyond Weird is a book about what quantum physics really means—and what it doesn’t. Science writer Philip Ball offers an up-to-date, accessible account of the quest to come to grips with the most fundamental theory of physical reality, and to explain how its counterintuitive principles underpin the world we experience. Over the past decade it has become clear that quantum physics is less a theory about particles and waves, uncertainty and fuzziness, than a theory about information and knowledge—about what can be known, and how we can know it. Discoveries and experiments over the past few decades have called into question the meanings and limits of space and time, cause and effect, and, ultimately, of knowledge itself. The quantum world Ball shows us isn’t a different world. It is our world, and if anything deserves to be called “weird,” it’s us.

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

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.

Epistemology and Probability Springer

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.

How Physics Confronts Reality W W Norton & Company Incorporated

Over the past years the author has developed a quantum language going beyond the concepts used by Bohr and Heisenberg. The simple formal algebraic language is designed to be consistent with quantum theory. It differs from natural languages in its epistemology, modal structure, logical connections, and copulatives. Starting from ideas of John von Neumann and in part also as a response to his fundamental work, the author bases his approach on what one really observes when studying quantum processes. This way the new language can be seen as a clue to a deeper understanding of the concepts of quantum physics, at the same time avoiding those paradoxes which arise when using natural languages. The work is organized didactically: The reader learns in fairly concrete form about the language and its structure as well as about its use for physics.

Einstein's Unfinished Revolution Springer

The Old Quantum Theory explains how the classical laws were modified by Planck, Einstein, Rutherford, Bohr, and other contributors to account for atomic phenomena, comprising the development of quantum theory from its start at the very end of the 19th century until the beginning of the 20th century. This book begins by discussing Planck's discovery of his radiation law, followed by Einstein's introduction to quanta. Next is a description of the Rutherford model of the atom and Bohr's postulates, which are confirmed by the Franck-Hertz experiment. This selection concludes with a description of how Bohr's theory could explain the main features of the atomic spectra. A brief summary of other important developments in the period are also elaborated. This publication is beneficial to students and researchers conducting work on the history of quantum mechanics from the 1900s to the development of wave mechanics.

Quantum Relativity Springer

Niels Bohr and the Quantum Atom is the first book that focuses in detail on the birth and development of Bohr's atomic theory and gives a comprehensive picture of it. At the same time it offers new insight into Bohr's peculiar way of thinking, what Einstein once called his 'unique instinct and tact'. Contrary to most other accounts of the Bohr atom, the book presents it in a broader perspective which includes the reception among other scientists and the criticism launched against it by scientists of a more conservative inclination. Moreover, it discusses the theory as Bohr originally conceived it, namely, as an ambitious theory covering the structure of atoms as well as molecules. By discussing the theory in its entirety it becomes possible to understand why it developed as it did and thereby to use it as an example of the dynamics of scientific theories.

On the Quantum Theory of Line-spectra Oxford University Press

A fascinating account of the development of quantum theory and emergence of quantum information theory.

How Two Great Minds Battled Quantum Randomness to Create a Unified Theory of Physics Anchor

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.

Beyond Weird Basic Books

Documents the 1932 gathering of some forty of the world's top names in physics, placing the meeting against a backdrop of key scientific developments while citing the contributions of specific figures and offering insight into how their unsuspecting collaborations gave way to subsequent historical events.

What Is Real? World Scientific

Manjit Kumar's superlative history of science's most fundamental revolution - in a brilliant illustrated edition. In this striking and sumptuous two-colour edition, Manjit Kumar's BBC Samuel Johnson Prize-shortlisted Quantum is wonderfully enriched by over 200 photos, artwork, maps and diagrams. It includes photos, some intimate and often little-seen before, of all the key protagonists; reproductions of key documents such as revealing letters and correspondence; detailed diagrams explaining the science and bringing to life classic thought experiments; and evocative portraits of the period, particularly of Cambridge, Copenhagen and Germany of the 1920s and 30s.

Why Everything You Thought You Knew about Quantum Physics Is Different Birkhäuser

'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 Unfinished Quest for the Meaning of Quantum Physics Springer Science & Business Media

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.

Einstein, Bohr and the Quantum Dilemma Cambridge University Press

From Aristotle's Physics to quantum teleportation, learn about the scientific pursuit of instantaneous connections in this insightful examination of our world. For millennia, scientists have puzzled over a simple question: Does the universe have a speed limit? If not, some effects could happen at the same instant as the actions that caused them -- and some effects, ludicrously, might even happen before their causes. By one hundred years ago, it seemed clear that the speed of light was the fastest possible speed. Causality was safe. And then quantum mechanics happened, introducing spooky connections that seemed to circumvent the law of cause and effect. Inspired by the new physics, psychologist Carl Jung and physicist Wolfgang Pauli explored a concept called synchronicity, a weird phenomenon they thought could link events without causes. Synchronicity tells that sprawling tale of insight and creativity, and asks where these ideas -- some plain crazy, and others crazy powerful -- are taking the human story next.

Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science University of Chicago Press

Niels Bohr ranks with Einstein among the physicists of the 20th century. He rose to this status through his invention of the quantum theory of the atom and his leadership in its defense and development. This book presents unpublished excerpts from extensive correspondence between Niels Bohr and his immediate family, and uses it to describe and analyze the psychological and cultural background to his invention. It also contains a reprinting of the three papers of1913 (the Trilogy in which Bohr worked out the provisional basis of his theory.

Quantum Weirdness: Einstein vs. Bohr Courier Corporation

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

in the chaos as we try to predict and control our world.
When Quantum Physics was Reborn World Scientific
QuantumEinstein, Bohr and the Great Debate About the Nature of RealityIcon Books Ltd
The Golden Age of Theoretical Physics QuantumEinstein, Bohr and the Great Debate About the Nature of Reality

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.