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Quantum Theory

Quantum Theory

Courier Corporation This advanced undergraduate-level text presents the quantum theory in terms of qualitative and imaginative concepts, followed by specific applications worked out in mathematical detail.

Wholeness and the Implicate Order

Routledge David Bohm was one of the foremost scientific thinkers and philosophers of our time. Although deeply influenced by Einstein, he was also, more unusually for a scientist, inspired by mysticism. Indeed, in the 1970s and 1980s he made contact with both J. Krishnamurti and the Dalai Lama whose teachings helped shape his work. In both science and philosophy, Bohm's main concern was with understanding the nature of reality in general and of consciousness in particular. In this classic work he develops a theory of quantum physics which treats the totality of existence as an unbroken whole. Writing clearly and without technical jargon, he makes complex ideas accessible to anyone interested in the nature of reality.

Emergent Quantum Mechanics

David Bohm Centennial Perspectives

MDPI Emergent quantum mechanics explores the possibility of an ontology for quantum mechanics. The resurgence of interest in "deeper-level" theories for quantum phenomena challenges the standard, textbook interpretation. The book presents expert views that critically evaluate the significance—for 21st century physics—of ontological quantum mechanics, an approach that David Bohm helped pioneer. The possibility of a deterministic quantum theory was first introduced with the original de Broglie-Bohm theory, which has also been developed as Bohmian mechanics. The wide range of perspectives that were contributed to this book on the occasion of David Bohm’s centennial celebration provide ample evidence for the physical consistency of ontological quantum mechanics. The book addresses deeper-level questions such as the following: Is reality intrinsically random or fundamentally interconnected? Is the universe local or nonlocal? Might a radically new conception of reality include a form of quantum causality or quantum ontology? What is the role of the experimenter agent? As the book demonstrates, the advancement of ‘quantum ontology’—as a scientific concept—marks a clear break with classical reality. The search for quantum reality entails unconventional causal structures and non-classical ontology, which can be fully consistent with the known record of quantum observations in the laboratory.

The Essential David Bohm

Routledge There are few scientists of the twentieth century whose life's work has created more excitement and controversy than that of physicist David Bohm (1917-1992). For the first time in a single volume, The Essential David Bohm offers a comprehensive overview of Bohm's original works from a non-technical perspective. Including three chapters of previously unpublished material, and a forward by the Dalai Lama, each reading has been selected to highlight some aspect of the implicate order process, and to provide an introduction to one of the most provocative thinkers of our time.

The Quantum Theory of Motion

An Account of the de Broglie-Bohm Causal Interpretation of Quantum Mechanics

Cambridge University Press An explanation of how quantum processes may be visualised without ambiguity, in terms of a simple physical model.

Gravity and the Quantum

Pedagogical Essays on Cosmology, Astrophysics, and Quantum Gravity

Springer This book provides a compilation of in-depth articles and reviews on key topics within gravitation, cosmology and related issues. It is a celebratory volume dedicated to Prof. Thanu Padmanabhan ("Paddy"), the renowned relativist and cosmologist from IUCAA, India, on the occasion of his 60th birthday. The authors, many of them leaders of their fields, are all colleagues, collaborators and former students of Paddy, who have worked with him over a research career spanning more than four decades. Paddy is a scientist of diverse interests, who attaches great importance to teaching. With this in mind, the aim of this compilation is to provide an accessible pedagogic introduction to, and overview of, various important topics in cosmology, gravitation and astrophysics. As such it will be an invaluable resource for scientists, graduate students and also advanced undergraduates seeking to broaden their horizons.

The Undivided Universe

An Ontological Interpretation of Quantum Theory

Routledge First published in 1995. Routledge is an imprint of Taylor & Francis, an informa company.

The Physics of Quantum Mechanics

Oxford University Press "First published by Cappella Archive in 2008."

Quantum Computation and Quantum Information

Cambridge University Press First-ever comprehensive introduction to the major new subject of quantum computing and quantum information.

David Bohm: Causality and Chance, Letters to Three Women

Springer The letters transcribed in this book were written by physicist David Bohm to three close female acquaintances in the period 1950 to 1956. They provide a background to his causal interpretation of quantum mechanics and the Marxist philosophy that inspired his scientific work in quantum theory, probability and statistical mechanics. In his letters, Bohm reveals the ideas that led to his ground breaking book Causality and Chance in Modern Physics. The political arguments as well as the acute personal problems contained in these letters help to give a rounded, human picture of this leading scientist and twentieth century thinker.

Wholeness and the Implicate Order

Psychology Press In this classic work Bohm, writing clearly and without technical jargon, develops a theory of quantum physics which treats the totality of existence as an unbroken whole.

Thought as a System

Second edition

Routledge First Published in 1994. Routledge is an imprint of Taylor & Francis, an informa company.

Bohmian Mechanics and Quantum Theory: An Appraisal

Springer Science & Business Media We are often told that quantum phenomena demand radical revisions of our scientific world view and that no physical theory describing well defined objects, such as particles described by their positions, evolving in a well defined way, let alone deterministically, can account for such phenomena. The great majority of physicists continue to subscribe to this view, despite the fact that just such a deterministic theory, accounting for all of the phe nomena of nonrelativistic quantum mechanics, was proposed by David Bohm more than four decades ago and has arguably been around almost since the inception of quantum mechanics itself. Our purpose in asking colleagues to write the essays for this volume has not been to produce a Festschrift in honor of David Bohm (worthy an undertaking as that would have been) or to gather together a collection of papers simply stating uncritically Bohm's views on quantum mechanics. The central theme around which the essays in this volume are arranged is David Bohm's version of quantum mechanics. It has by now become fairly standard practice to refer to his theory as Bohmian mechanics and to the larger conceptual framework within which this is located as the causal quantum theory program. While it is true that one can have reservations about the appropriateness of these specific labels, both do elicit distinc tive images characteristic of the key concepts of these approaches and such terminology does serve effectively to contrast this class of theories with more standard formulations of quantum theory.

The Quantum Hall Effect

Springer Science & Business Media After a foreword by Klaus von Klitzing, the first chapters of this book discuss the prehistory and the theoretical basis as well as the implications of the discovery of the Quantum Hall effect on superconductivity, superfluidity, and metrology, including experimentation. The second half of this volume is concerned with the theory of and experiments on the many body problem posed by fractional effect. Specific unsolved problems are mentioned throughout the book and a summary is made in the final chapter. The quantum Hall effect was discovered on about the hundredth anniversary of Hall's original work, and the finding was announced in 1980 by von Klitzing, Dorda and Pepper. Klaus von Klitzing was awarded the 1985 Nobel prize in physics for this discovery.

Causality and Chance in Modern Physics

University of Pennsylvania Press In this classic, David Bohm was the first to offer us his causal interpretation of the quantum theory. Causality and Chance in Modern Physics continues to make possible further insight into the meaning of the quantum theory and to suggest ways of extending the theory into new directions.

Mind, Matter, and Quantum Mechanics

Springer Science & Business Media Nature appears to be composed of two completely different kinds of things: rocklike things and idealike things. The first is epitomized by an enduring rock, the second by a fleeting thought. A rock can be experienced by many of us together, while a thought seems to belong to one of us alone. Thoughts and rocks are intertwined in the unfolding of nature, as Michelangelo's David so eloquently attests. Yet is it possible to under stand rationally how two completely different kinds of things can interact with each other? Logic says no, and history confirms that verdict. To form a rational comprehension of the interplay between the matterlike and mind like parts of nature these two components ought to be understood as aspects of some single primal stuff. But what is the nature of a primal stuff that can have mind and matter as two of its aspects? An answer to this age-old question has now been forced upon us. Physi cists, probing ever deeper into the nature of matter, found that they were forced to bring into their theory the human observers and their thoughts. Moreover, the mathematical structure of the theory combines in a marvelous way the features of nature that go with the concepts of mind and matter. Although it is possible, in the face of this linkage, to try to maintain

the tra ditionallogical nonrelatedness of these two aspects of nature, that endeavor leads to great puzzles and mysteries.

Making Sense of Quantum Mechanics

Springer This book explains, in simple terms, with a minimum of mathematics, why things can appear to be in two places at the same time, why correlations between simultaneous events occurring far apart cannot be explained by local mechanisms, and why, nevertheless, the quantum theory can be understood in terms of matter in motion. No need to worry, as some people do, whether a cat can be both dead and alive, whether the moon is there when nobody looks at it, or whether quantum systems need an observer to acquire definite properties. The author’s inimitable and even humorous style makes the book a pleasure to read while bringing a new clarity to many of the longstanding puzzles of quantum physics.

The undivided universe

an ontological interpretation of quantum theory

Burns & Oates 'In The Undivided Universe, ' Professor David Bohm, one of the foremost scientific thinkers and one of the most distinguished physicists of his generation, presents a radically different approach to quantum theory.

The Quantum Dissidents

Rebuilding the Foundations of Quantum Mechanics (1950-1990)

Springer 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.

Unfolding Meaning

A Weekend of Dialogue with David Bohm

Routledge First published in 1987. Routledge is an imprint of Taylor & Francis, an informa company.

The Quantum World

Philosophical Debates on Quantum Physics

Springer In this largely nontechnical book, eminent physicists and philosophers address the philosophical impact of recent advances in quantum physics. These are shown to shed new light on profound questions about realism, determinism, causality or locality. The participants contribute in the spirit of an open and honest discussion, reminiscent of the time when science and philosophy were inseparable. After the editors' introduction, the next chapter reveals the strangeness of quantum mechanics and the subsequent discussions examine our notion of reality. The spotlight is then turned to the topic of decoherence. Bohm's theory is critically examined in two chapters, and the relational interpretation of quantum mechanics is likewise described and discussed. The penultimate chapter presents a proposal for resolving the measurement problem, and finally the topic of loop quantum gravity is presented by one of its founding fathers, Carlo Rovelli. The original presentations and discussions on which this volume is based took place under the auspices of the French "Académie des Sciences Morales et Politiques". The book will appeal to everybody interested in knowing how our description of the world is impacted by the results of the most powerful and successful theory that physicists have ever built.

Scientific Metaphysics

Oxford University Press Scientific Metaphysics collects original essays by leading philosophers of science on the question of whether metaphysics can and should be naturalized--that is, conducted as a part of natural science. Some people think the idea of naturalized metaphysics is a contradiction in terms: metaphysics is by definition about matters that transcend the domain of empirical inquiry. Most of the authors here disagree: they argue that if metaphysics is to hold outany prospect of identifying objective truths, it must be continuous with and inspired by science, or even be of some positive use to science. The essays offer various points of view on the relationship betweennaturalized metaphysics, more traditional forms of metaphysics, and the wider history of philosophy, and draw on examples from physics, biology, economics, psychology. At stake is the question of whether metaphysics should give way to science and disappear from contemporary inquiry, or continue as an activity that unifies the particular sciences into a single naturalistic worldview.

Decoding Reality

The Universe as Quantum Information

OUP Oxford For a physicist, all the world is information. The Universe and its workings are the ebb and flow of information. We are all transient patterns of information, passing on the recipe for our basic forms to future generations using a four-letter digital code called DNA. In this engaging and mind-stretching account, Vlatko Vedral considers some of the deepest questions about the Universe and considers the implications of interpreting it in terms of information. He explains the nature of information, the idea of entropy, and the roots of this thinking in thermodynamics. He describes the bizarre effects of quantum behaviour — effects such as 'entanglement', which Einstein called 'spooky action at a distance', and explores cutting edge work on harnessing quantum effects in hyperfast quantum computers, and how recent evidence suggests that the weirdness of the quantum world, once thought limited to the tiniest scales, may reach into the macro world. Vedral finishes by considering the answer to the ultimate question: where did all of the information in the Universe come from? The answers he considers are exhilarating, drawing upon the work of distinguished physicist John Wheeler. The ideas challenge our concept of the nature of particles, of time, of determinism, and of reality itself. This edition includes a new foreword from the author, reflecting on changes in the world of quantum information since first publication. Oxford

Landmark Science books are 'must-read' classics of modern science writing which have crystallized big ideas, and shaped the way we think.

Quantum Computing

The Transformative Technology of the Qubit Revolution

Icon Books The ultimate non-technical guide to the fast-developing world of quantum computing Computer technology has improved exponentially over the last 50 years. But the headroom for bigger and better electronic solutions is running out. Our best hope is to engage the power of quantum physics. ‘Quantum algorithms’ had already been written long before hardware was built. These would enable, for example, a quantum computer to exponentially speed up an information search, or to crack the mathematical trick behind internet security. However, making a quantum computer is incredibly difficult. Despite hundreds of laboratories around the world working on them, we are only just seeing them come close to ‘supremacy’ where they can outperform a traditional computer. In this approachable introduction, Brian Clegg explains algorithms and their quantum counterparts, explores the physical building blocks and quantum weirdness necessary to make a quantum computer, and uncovers the capabilities of the current generation of machines.

Science, Order and Creativity

Routledge One of the foremost scientists and thinkers of our time, David Bohm worked alongside Oppenheimer and Einstein. In Science, Order and Creativity he and physicist F. David Peat propose a return to greater creativity and communication in the sciences. They ask for a renewed emphasis on ideas rather than formulae, on the whole rather than fragments, and on meaning rather than mere mechanics. Tracing the history of science from Aristotle to Einstein, from the Pythagorean theorem to quantum mechanics, the authors offer intriguing new insights into how scientific theories come into being, how to eliminate blocks to creativity and how science can lead to a deeper understanding of society, the human condition and the human mind itself. Science, Order and Creativity looks to the future of science with elegance, hope and enthusiasm.

Quantum Theory: A Two-Time Success Story

Yakir Aharonov Festschrift

Springer Science & Business Media Yakir Aharonov is one of the leading figures in the foundations of quantum physics. His contributions range from the celebrated Aharonov-Bohm effect (1959), to the more recent theory of weak measurements (whose experimental confirmations were recently ranked as the two most important results of physics in 2011). This volume will contain 27 original articles, contributed by the most important names in quantum physics, in honor of Aharonov's 80-th birthday. Sections include "Quantum mechanics and reality," with contributions from Nobel Laureates David Gross and Sir Anthony Leggett and Yakir Aharonov, S. Popescu and J. Tollaksen; "Building blocks of Nature" with contributions from Francois Englert (co-proposer of the scalar boson along with Peter Higgs); "Time and Cosmology" with contributions from Leonard Susskind, P.C.W. Davies and James Hartle; "Universe as a Wavefunction," with contributions from Phil Pearle, Sean Carroll and David Albert; "Nonlocality," with contributions from Nicolas Gisin, Daniel Rohrlich, Ray Chiao and Lev Vaidman; and finishing with multiple sections on weak values with contributions from A. Jordan, A. Botero, A.D. Parks, L. Johansen, F. Colombo, I. Sabadini, D.C. Struppa, M.V. Berry, B. Reznik, N. Turok, G.A.D. Briggs, Y. Gefen, P. Kwiat, and A. Pines, among others.

The Philosophy of Quantum Physics

Springer This book provides a thorough and up-to-date introduction to the philosophy of quantum physics. Although quantum theory is renowned for its spectacular empirical successes, controversial discussion about how it should be understood continue to rage today. In this volume, the authors provide an overview of its numerous philosophical challenges: Do quantum objects violate the principle of causality? Are particles of the same type indistinguishable and therefore not individual entities? Do quantum objects retain their identity over time? How does a compound quantum system relate to its parts? These questions are answered here within different interpretational approaches to quantum theory. Finally, moving to Quantum Field Theory, we find that the problem of non-locality is exacerbated. Philosophy of quantum physics is aimed at philosophers with an interest in physics, while also serving to familiarize physicists with many of the essential philosophical questions of their subject.

Quantum Theory: Concepts and Methods

Springer Science & Business Media There are many excellent books on quantum theory from which one can learn to compute energy levels, transition rates, cross sections, etc. The theoretical rules given in these books are routinely used by physicists to compute observable quantities. Their predictions can then be compared with experimental data. There is no fundamental disagreement among physicists on how to use the theory for these practical purposes. However, there are profound differences in their opinions on the ontological meaning of quantum theory. The purpose of this book is to clarify the conceptual meaning of quantum theory, and to explain some of the mathematical methods which it utilizes. This text is not concerned with specialized topics such as atomic structure, or strong or weak interactions, but with the very foundations of the theory. This is not, however, a book on the philosophy of science. The approach is pragmatic and strictly instrumentalist. This attitude will undoubtedly antagonize some readers, but it has its own logic: quantum phenomena do not occur in a Hilbert space, they occur in a laboratory.

Quantum Mechanics

Historical Contingency and the Copenhagen Hegemony

University of Chicago Press Why does one theory "succeed" while another, possibly clearer interpretation, fails? By exploring two observationally equivalent yet conceptually incompatible views of quantum mechanics, James T. Cushing shows how historical contingency can be crucial to determining a theory's construction and its position among competing views. Since the late 1920s, the theory formulated by Niels Bohr and his colleagues at Copenhagen has been the dominant interpretation of quantum mechanics. Yet an alternative interpretation, rooted in the work of Louis de Broglie in the early 1920s and reformulated and extended by David Bohm in the 1950s, equally well explains the observational data. Through a detailed historical and sociological study of the physicists who developed different theories of quantum mechanics, the debates within and between opposing camps, and the receptions given to each theory, Cushing shows that despite the preeminence of the Copenhagen view, the Bohm interpretation cannot be ignored. Cushing contends that the Copenhagen interpretation became widely accepted not because it is a better explanation of subatomic phenomena than is Bohm's, but because it happened to appear first. Focusing on the philosophical, social, and cultural forces that shaped one of the most important developments in modern physics, this provocative book examines the role that timing can play in

the establishment of theory and explanation.

YinYang Bipolar Relativity: A Unifying Theory of Nature, Agents and Causality with Applications in Quantum Computing, Cognitive Informatics and Life Sciences

A Unifying Theory of Nature, Agents and Causality with Applications in Quantum Computing, Cognitive Informatics and Life Sciences

IGI Global YinYang bipolar relativity can trace its philosophical origins to ancient Chinese YinYang cosmology, which claims that everything has two sides or two opposite, but reciprocal, poles or energies. More specifically, this discipline is intended to be a logical unification of general relativity and quantum mechanics. YinYang Bipolar Relativity: A Unifying Theory of Nature, Agents and Causality with Applications in Quantum Computing, Cognitive Informatics and Life Sciences presents real-world applications of YinYang bipolar relativity that focus on quantum computing and agent interaction. This unique work makes complex theoretical topics, such as the ubiquitous effects of quantum entanglement, logically comprehendible to a vast audience.

Introduction to Topological Quantum Computation

Cambridge University Press Ideal for graduate students and researchers from various sub-disciplines, this book provides an excellent introduction to topological quantum computation.

The Amazing World of Quantum Computing

Springer Nature This book discusses the application of quantum mechanics to computing. It explains the fundamental concepts of quantum mechanics and then goes on to discuss various elements of mathematics required for quantum computing. Quantum cryptography, waves and Fourier analysis, measuring quantum systems, comparison to classical mechanics, quantum gates, and important algorithms in quantum computing are among the topics covered. The book offers a valuable resource for graduate and senior undergraduate students in STEM (science, technology, engineering, and mathematics) fields with an interest in designing quantum algorithms. Readers are expected to have a firm grasp of linear algebra and some familiarity with Fourier analysis.

Quantum Nonlocality and Reality

50 Years of Bell's Theorem

Cambridge University Press A collaboration between distinguished physicists and philosophers of physics, this important anthology surveys the deep implications of Bell's nonlocality theorem.

Foundations of Quantum Mechanics

An Exploration of the Physical Meaning of Quantum Theory

Springer Authored by an acclaimed teacher of quantum physics and philosophy, this textbook pays special attention to the aspects that many courses sweep under the carpet. Traditional courses in quantum mechanics teach students how to use the quantum formalism to make calculations. But even the best students - indeed, especially the best students - emerge rather confused about what, exactly, the theory says is going on, physically, in microscopic systems. This supplementary textbook is designed to help such students understand that they are not alone in their confusions (luminaries such as Albert Einstein, Erwin Schroedinger, and John

Stewart Bell having shared them), to sharpen their understanding of the most important difficulties associated with interpreting quantum theory in a realistic manner, and to introduce them to the most promising attempts to formulate the theory in a way that is physically clear and coherent. The text is accessible to students with at least one semester of prior exposure to quantum (or "modern") physics and includes over a hundred engaging end-of-chapter "Projects" that make the book suitable for either a traditional classroom or for self-study.

Quantum Mechanics

Cambridge University Press The important changes quantum mechanics has undergone in recent years are reflected in this approach for students. A strong narrative and over 300 worked problems lead the student from experiment, through general principles of the theory, to modern applications. Stepping through results allows students to gain a thorough understanding. Starting with basic quantum mechanics, the book moves on to more advanced theory, followed by applications, perturbation methods and special fields, and ending with developments in the field. Historical, mathematical and philosophical boxes guide the student through the theory. Unique to this textbook are chapters on measurement and quantum optics, both at the forefront of current research. Advanced undergraduate and graduate students will benefit from this perspective on the fundamental physical paradigm and its applications. Online resources including solutions to selected problems, and 200 figures, with colour versions of some figures, are available at www.cambridge.org/Auletta.

David Bohm

A Life Dedicated to Understanding the Quantum World

Springer Nature This authoritative biography addresses the life and work of the quantum physicist David Bohm. Although quantum physics is considered the soundest physical theory, its strange and paradoxical features have challenged - and continue to challenge - even the brightest thinkers. David Bohm dedicated his entire life to enhancing our understanding of quantum mysteries, in particular quantum nonlocality. His work took place at the height of the cultural/political upheaval in the 1950's, which led him to become the most notable American scientist to seek exile in the last century. The story of his life is as fascinating as his ideas on the quantum world are appealing.

Philosophy and Logic of Quantum Physics

An Investigation of the Metaphysical and Logical Implications of Quantum Physics

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

W. W. Norton & Company "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.

Infinite Potential

The Life And Times Of David Bohm

Perseus Books Recounts the life of the physicist, psychologist, and philosopher David Bohm, including his friendship with J. Robert Oppenheimer and his protest against Senator Joseph McCarthy, and explains his landmark scientific discoveries and his work with Eastern philosophy.