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Compendium of Quantum Physics Concepts, Experiments, History and Philosophy Springer Science & Business Media *With contributions by leading quantum physicists, philosophers and historians, this comprehensive A-to-Z of quantum physics provides a lucid understanding of key concepts of quantum theory and experiment. It covers technical and interpretational aspects alike, and includes both traditional and new concepts, making it an indispensable resource for concise, up-to-date information about the many facets of quantum physics.* **A History of the Ideas of Theoretical Physics Essays on the Nineteenth and Twentieth Century Physics Springer Science & Business Media** *This book presents a perspective on the history of theoretical physics over the past two hundreds years. It comprises essays on the history of pre-Maxwellian electrodynamics, of Maxwell's and Hertz's field theories, and of the present century's relativity and quantum physics. A common thread across the essays is the search for and the exploration of themes that influenced significant con ceptual changes in the great movement of ideas and experiments which heralded the emergence of theoretical physics (hereafter: TP). The fun. damental change involved the recognition of the scien tific validity of theoretical physics. In the second half of the nine teenth century, it was not easy for many physicists to understand the nature and scope of theoretical physics and of its adept, the theoreti cal physicist. A physicist like Ludwig Boltzmann, one of the eminent contributors to the new discipline, confessed in 1895 that, "even the formulation of this concept [of a theoretical physicist] is not entirely without difficulty". 1 Although science had always been divided into theory and experiment, it was only in physics that theoretical work developed into a major research and teaching specialty in its own right. 2 It is true that theoretical physics was mainly a creation of tum of-the century German physics, where it received full institutional recognition, but it is also undeniable that outstanding physicists in other European countries, namely, Ampere, Fourier, and Maxwell, also had an important part in its creation.* **Quantum Mechanics at the Crossroads New Perspectives from History, Philosophy and Physics Springer Science & Business Media** *This volume brings together leading quantum physicists to expound on the meaning and future directions of quantum mechanics. It offers new insights from different vantage points to tackle essential questions in quantum mechanics and its interpretation. All the authors have written for a broad readership, and the resulting volume will appeal to everyone wishing to keep abreast of new developments in quantum mechanics, as well as its history and philosophy.* **Forces and Fields The Concept of Action at a Distance in the History of Physics Courier Corporation** *This history of physics focuses on the question, "How do bodies act on one another across space?" The variety of answers illustrates the function of fundamental analogies or models in physics, as well as the role of so-called unobservable entities. Forces and Fields presents an in-depth look at the science of ancient Greece, and it examines the influence of antique philosophy on seventeenth-century thought. Additional topics embrace many elements of modern physics—the empirical basis of quantum mechanics, wave-particle duality and the uncertainty principle, and the action-at-a-distance theory of Wheeler and Feynman. The introductory chapter, in which the philosophical view is developed, can be omitted by readers more interested in history. Author Mary B. Hesse examines the use of analogies in primitive scientific explanation, particularly in the works of Aristotle, and contrasts them with latter-day theories such as those of gravitation and relativity. Hesse incorporates studies of the Pre-Socratics initiated by Francis Cornford and continued by contemporary classical historians. Her perspective sheds considerable light on the scientific thinking of antiquity, and it highlights the debt that the seventeenth-century natural philosophers owed to Greek ideas.* **Quantum Causality Conceptual Issues in the Causal Theory of Quantum Mechanics Springer Science & Business Media** *There is no sharp dividing line between the foundations of physics and philosophy of physics. This is especially true for quantum mechanics. The debate on the interpretation of quantum mechanics has raged in both the scientific and philosophical communities since the 1920s and continues to this day. (We shall understand the unqualified term ‘quantum mechanics’ to mean the mathematical formalism, i. e. laws and rules by which empirical predictions and theoretical advances are made.) There is a popular rendering of quantum mechanics which has been publicly endorsed by some well known physicists which says that quantum mechanics is not only 1 more weird than we imagine but is weirder than we can imagine. Although it is readily granted that quantum mechanics has produced some strange and counter-intuitive results, the case will be presented*

in this book that quantum mechanics is not as weird as we might have been led to believe! The prevailing theory of quantum mechanics is called Orthodox Quantum Theory (also known as the Copenhagen Interpretation). Orthodox Quantum Theory endows a special status on measurement processes by requiring an intervention of an observer or an observer's proxy (e. g. a measuring apparatus). The placement of the observer (or proxy) is somewhat arbitrary which introduces a degree of subjectivity. Orthodox Quantum Theory only predicts probabilities for measured values of physical quantities. It is essentially an instrumental theory, i. e. **Philosophy of Physics: a Very Short Introduction Oxford University Press** *Philosophy of physics is concerned with the deepest theories of modern physics - quantum theory, our theories of space, time and symmetry, and thermal physics - and their strange, even bizarre conceptual implications. This book explores the core topics in philosophy of physics, and discusses their relevance for both scientists and philosophers.* **Physics and Philosophy The Revolution in Modern Science Harpercollins College Division** *Traces the history of quantum theory and its relation to the development of Western philosophical ideas and natural sciences* **Grete Hermann - Between Physics and Philosophy Springer** *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.* **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.* **Quantum Philosophy Understanding and Interpreting Contemporary Science Princeton University Press** *This volume reviews the history and development of mathematics, logic and the physical sciences to show that late 20th-century work in quantum theory offers answers to questions that have puzzled philosophers for centuries such as: is the world ultimately intelligible?* **The Quantum Theory—Origins and Ideas A Historical Primer for Physics Students Springer Nature** *This book offers a fresh perspective on some of the central experimental and theoretical works that laid the foundations for today's quantum mechanics: It traces the theoretical and mathematical development of the hypotheses that put forward to explain puzzling experimental results; it also examines their interconnections and how they together evolved into modern quantum theory. Particular attention is paid to J.J. Thomson's atomic modeling and experiments at the Cavendish Laboratory, Max Planck's struggle to explain the experimental results of Heinrich Rubens and Ferdinand Kurlbaum, as well as the path leading from Louis de Broglie's ideas to the wave theory of Erwin Schrödinger. Combining his experience in teaching quantum mechanics with his interest in the historical roots of the subject, the author has created a valuable resource for understanding quantum physics through its history, and a book that is appreciated both by working physicists and historians.* **Schrödinger's Philosophy of Quantum Mechanics Springer Science & Business Media** *This book is the final outcome of two projects. My first project was to publish a set of texts written by Schrodinger at the beginning of the 1950's for his seminars and lectures at the Dublin Institute for Advanced Studies. These almost completely forgotten texts contained important insights into the interpretation of quantum mechanics, and they provided several ideas which were missing or elusively expressed in SchrOdinger's published papers and books of the same period. However, they were likely to be misinterpreted out of their context. The problem was that current scholarship could not help very much the reader of these writings to figure out their significance. The few available studies about SchrOdinger's interpretation of quantum mechanics are generally excellent, but almost entirely restricted to the initial period 1925-1927. Very little work has been done on Schrodinger's late views on the theory he contributed to create and develop. The generally accepted view is that he never really recovered from his interpretative failure of 1926-1927, and that his late reflections (during the 1950's) are little more than an expression of his rising nostalgia for the lost ideal of picturing the world, not to say for some favourite traditional picture. But the content and style of Schrodinger's texts of the 1950's do not agree at all with this melancholic appraisal; they rather set the stage for a thorough renewal of accepted representations. In order to elucidate this paradox, I adopted several strategies.* **Integrating History and Philosophy of Science Problems and Prospects Springer Science & Business Media** *Though the publication of Kuhn's Structure of Scientific Revolutions seemed to herald the advent of a unified study of the history and philosophy of science, it is a hard fact that history of science and philosophy of science have increasingly grown apart. Recently, however, there has been a series of workshops on both sides of the Atlantic (called '&HPS') intended to bring historians and philosophers of science together to discuss new integrative approaches. This is therefore an especially appropriate time to explore the problems with and prospects for integrating history and philosophy of science. The original essays in this volume, all from specialists in the history of science or philosophy of science, offer such an exploration from a wide variety of perspectives. The volume combines general reflections on the current state of history and philosophy of science with studies of the relation between the two disciplines in specific historical and scientific cases.* **From Data to Quanta Niels Bohr's Vision of Physics University of Chicago Press** *The first comprehensive philosophical and historical account of the experimental foundations of Niels Bohr's practice of physics. Niels Bohr was a central figure in quantum physics, well known for his work on atomic structure and his*

contributions to the Copenhagen interpretation of quantum mechanics. In this book, philosopher of science Slobodan Perović explores the way Bohr practiced and understood physics, and analyzes its implications for our understanding of modern science. Perović develops a novel approach to Bohr's understanding of physics and his method of inquiry, presenting an exploratory symbiosis of historical and philosophical analysis that uncovers the key aspects of Bohr's philosophical vision of physics within a given historical context. To better understand the methods that produced Bohr's breakthrough results in quantum phenomena, Perović clarifies the nature of Bohr's engagement with the experimental side of physics and lays out the basic distinctions and concepts that characterize his approach. Rich and insightful, Perović's take on the early history of quantum mechanics and its methodological ramifications sheds vital new light on one of the key figures of modern physics. **History of Science as a Facilitator for the Study of Physics A Repertoire of Quantum Theory Cambridge Scholars Publishing** *This book serves to enhance scientific and technological literacy, by promoting STEM (Science, Technology, Engineering, and Mathematics) education with particular reference to contemporary physics. The study is presented in the form of a repertoire, and it gives the reader a glimpse of the conceptual structure and development of quantum theory along a rational line of thought, whose understanding might be the key to introducing young generations of students to physics. The recurrent theme here is that the conceptual extension of the concept of natural radiation (symbolized by the constant h) allows an easy method of charting the conceptual development of quantum theory. The repertoire focuses on some momentous events of quantum theory, including the discovery of the constant h, which is one of the fundamental constants of nature and the key to understanding quantum mechanics; the discovery of the photon by Albert Einstein; and Niels Bohr's model of the hydrogen atom; the experiments which led to disclosing the structure of atomic nuclei in the 1930s; and the discovery of quantum mechanics and quantum electrodynamics, which constitute the basis of contemporary particle physics.* **The Foundations of Quantum Mechanics, Historical Analysis and Open Questions - Cesena 2004 Cesena, Italy, 4-9 Ocober 2004 World Scientific** *This volume provides a unique overview of recent Italian studies on the foundations of quantum mechanics and related historical, philosophical and epistemological topics. A gathering of scholars from diverse cultural backgrounds, the conference provided a forum for a fascinating exchange of ideas and perspectives on a range of open questions in quantum mechanics. The varied nature of the papers in this volume attests to the achievement of that aim with many contributions providing original solutions to established problems by taking into account recommendations from different disciplines. Contents: If Bertlmann had Three Feet (A Afriat); Macroscopic Interpretability of Quantum Component Systems (R Ascoli); Entanglement State Preparation in Experiments on Quantum Non-Locality (V Berardi & A Garuccio); Mathematics and Epistemology in Planck''s Theoretical Work (1898OCo1915) (P Campogalliani); The Electromagnetic Conception of Nature and the Origins of Quantum Physics (E A Giannetto); An Objective Background for Quantum Theory Relaying on Thermodynamic Concepts (L Lanz & B Vacchini); The Entrance of Quantum Mechanics in Italy: From Garbasso to Fermi (M Leone & N Robotti); Antonio Gramsci''s Reflection on Quantum Mechanics (I Tassani); The Role of Logic and Mathematics in the Heisenberg Formulation of Quantum Mechanics (A Venezia); Space-Time at the Planck Scale: The Quantum Computer View (P A Zizzi); and other papers. Readership: Physicists interested in the foundation of quantum mechanics; historians interested in the history and development of modern physics; philosophers interested in the epistemology and philosophy of modern physics."* **Physics and Speculative Philosophy Potentiality in Modern Science Walter de Gruyter GmbH & Co KG** *Through both an historical and philosophical analysis of the concept of possibility, we show how including both potentiality and actuality as part of the real is both compatible with experience and contributes to solving key problems of fundamental process and emergence. The book is organized into four main sections that incorporate our routes to potentiality: (1) potentiality in modern science [history and philosophy; quantum physics and complexity]; (2) Relational Realism [ontological interpretation of quantum physics; philosophy and logic]; (3) Process Physics [ontological interpretation of relativity theory; physics and philosophy]; (4) on speculative philosophy and physics [limitations and approximations; process philosophy]. We conclude that certain fundamental problems in modern physics require complementary analyses of certain philosophical and metaphysical issues, and that such scholarship reveals intrinsic features and limits of determinism, potentiality and emergence that enable, among others, important progress on the quantum theory of measurement problem and new understandings of emergence.* **Scientific Concepts and Investigative Practice Walter de Gruyter** *Recent philosophy and history of science have seen a surge of interest in the role of concepts in scientific research. Combining philosophical and historical scholarship, the articles in this volume investigate the ways in which scientists form and use concepts, rather than in what the concepts themselves represent. The fields treated range from mathematics to virology and genetics, from nuclear physics to psychology, from technology to present-day neural engineering.* **Reality Without Realism Matter, Thought, and Technology in Quantum Physics Springer Nature** *This book presents quantum theory as a theory based on new relationships among matter, thought, and experimental technology, as against those previously found in physics, relationships that also redefine those between mathematics and physics in quantum theory. The argument of the book is based on its title concept, reality without realism (RWR), and in the corresponding view, the RWR view, of quantum theory. The book considers, from this perspective, the thinking of Bohr, Heisenberg, Schrödinger, and Dirac, with the aim of bringing together the philosophy and history of quantum theory. With quantum theory, the book argues, the architecture of thought in theoretical physics was radically changed by the irreducible role of experimental technology in the constitution of physical phenomena, accordingly, no longer defined independently by matter alone, as they were in classical physics or relativity. Or so it appeared. For, quantum theory, the book further argues, made us realize that experimental technology, beginning with that of our bodies, irreducibly shapes all physical phenomena, and thus makes us rethink the relationships among matter, thought, and technology in all of physics.* **Philosophy of Physics Quantum Theory Princeton University Press** *A sophisticated and original introduction to the philosophy of quantum mechanics from one of the world's leading philosophers of physics In this book, Tim Maudlin, one of the world's leading philosophers of physics, offers a sophisticated, original introduction to the philosophy of quantum mechanics. The briefest, clearest, and most refined account of his influential approach to the subject, the book will be invaluable to all students of philosophy and physics. Quantum mechanics holds a unique place in the history of physics. It has produced the most accurate predictions of any scientific theory, but, more astonishing, there has never been any agreement about what the theory implies about physical reality. Maudlin argues that the very term "quantum theory" is a misnomer. A proper physical theory should clearly describe*

what is there and what it does—yet standard textbooks present quantum mechanics as a predictive recipe in search of a physical theory. In contrast, Maudlin explores three proper theories that recover the quantum predictions: the indeterministic wavefunction collapse theory of Ghirardi, Rimini, and Weber; the deterministic particle theory of deBroglie and Bohm; and the conceptually challenging Many Worlds theory of Everett. Each offers a radically different proposal for the nature of physical reality, but Maudlin shows that none of them are what they are generally taken to be. **Philosophical Reflections and Syntheses Springer Science & Business Media** *Among the founding fathers of modern quantum physics few have contributed to our basic understanding of its concepts as much as E.P. Wigner. His articles on the epistemology of quantum mechanics and the measurement problem, and the basic role of symmetries were of fundamental importance for all subsequent work. He was also the first to discuss the concept of consciousness from the point of view of modern physics. G.G. Emch edited most of those papers and wrote a very helpful introduction into Wigner's contributions to Natural Philosophy. The book should be a gem for all those interested in the history and philosophy of science.* **Quantum Reprogramming Ensembles and Single Systems: A Two-Tier Approach to Quantum Mechanics Springer Science & Business Media** *Many, perhaps most textbooks of quantum mechanics present a Copenhagen, single system angle; fewer present the subject matter as an instrument for treating ensembles, but the two methods have been silently coexisting since the mid-Thirties. This lingering dichotomy of purpose for a major physical discipline has much shrouded further insights into the foundations of quantum theory. Quantum Reprogramming resolves this long-standing dichotomy by examining the mutual relation between single systems and ensembles, assigning each its own tools for treating the subject at hand: i.e., Schrödinger-Dirac methods for ensembles versus period integrals for single systems. A unified treatment of integer and fractional quantum Hall effects and a finite description of the electron's anomalies are mentioned as measures of justification for the chosen procedure of resolving an old-time dichotomy. The methods of presentation are, in part, elementary, with repetitive references needed to delineate differences with respect to standard methods. The parts on period integrals are developed with a perspective on elementary methods in physics, thus leading up to some standard results of de Rham theory and algebraic topology. Audience: Students of physics, mathematics, philosophers as well as outsiders with a general interest in the conceptual development of physics will find useful reading in these pages, which will stimulate further inquiry and study.* **The Oxford Handbook of the History of Quantum Interpretations Oxford University Press** *Crucial to most research in physics, as well as leading to the development of inventions such as the transistor and the laser, quantum mechanics approaches its centenary with an impressive record. However, the field has also long been the subject of ongoing debates about the foundations and interpretation of the theory, referred to as the quantum controversy. This Oxford Handbook offers a historical overview of the contrasts which have been at the heart of quantum physics for the last 100 years. Drawing on the wide-ranging expertise of several contributors working across physics, history, and philosophy, the handbook outlines the main theories and interpretations of quantum physics. It goes on to tackle the key controversies surrounding the field, touching on issues such as determinism, realism, locality, classicality, information, measurements, mathematical foundations, and the links between quantum theory and gravity. This engaging introduction is an essential guide for all those interested in the history of scientific controversies and history of quantum physics. It also provides a fascinating examination of the potential of quantum physics to influence new discoveries and advances in fields such quantum information and computing.* **International Handbook of Research in History, Philosophy and Science Teaching Springer** *This inaugural handbook documents the distinctive research field that utilizes history and philosophy in investigation of theoretical, curricular and pedagogical issues in the teaching of science and mathematics. It is contributed to by 130 researchers from 30 countries; it provides a logically structured, fully referenced guide to the ways in which science and mathematics education is, informed by the history and philosophy of these disciplines, as well as by the philosophy of education more generally. The first handbook to cover the field, it lays down a much-needed marker of progress to date and provides a platform for informed and coherent future analysis and research of the subject. The publication comes at a time of heightened worldwide concern over the standard of science and mathematics education, attended by fierce debate over how best to reform curricula and enliven student engagement in the subjects. There is a growing recognition among educators and policy makers that the learning of science must dovetail with learning about science; this handbook is uniquely positioned as a locus for the discussion. The handbook features sections on pedagogical, theoretical, national, and biographical research, setting the literature of each tradition in its historical context. It reminds readers at a crucial juncture that there has been a long and rich tradition of historical and philosophical engagements with science and mathematics teaching, and that lessons can be learnt from these engagements for the resolution of current theoretical, curricular and pedagogical questions that face teachers and administrators. Science educators will be grateful for this unique, encyclopaedic handbook, Gerald Holton, Physics Department, Harvard University This handbook gathers the fruits of over thirty years' research by a growing international and cosmopolitan community Fabio Bevilacqua, Physics Department, University of Pavia* **One Hundred Years of Gauge Theory Past, Present and Future Perspectives Springer Nature** *This book presents a multidisciplinary guide to gauge theory and gravity, with chapters by the world's leading theoretical physicists, mathematicians, historians and philosophers of science. The contributions from theoretical physics explore e.g. the consistency of the unification of gravitation and quantum theory, the underpinnings of experimental tests of gauge theory and its role in shedding light on the relationship between mathematics and physics. In turn, historians and philosophers of science assess the impact of Weyl's view on the philosophy of science. Graduate students, lecturers and researchers in the fields of history of science, theoretical physics and philosophy of science will benefit from this book by learning about the role played by Weyl's Raum-Zeit-Materie in shaping several modern research fields, and by gaining insights into the future prospects of gauge theory in both theoretical and experimental physics. Furthermore, the book facilitates interdisciplinary exchange and conceptual innovation in tackling fundamental questions about our deepest theories of physics. Chapter "Weyl's Raum-Zeit-Materie and the Philosophy of Science" is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com* **Copernicus, Darwin, and Freud Revolutions in the History and Philosophy of Science John Wiley & Sons** *Using Copernicanism, Darwinism, and Freudianism as examples of scientific traditions, Copernicus, Darwin and Freud takes a philosophical look at these three revolutions in thought to illustrate the connections between science and philosophy. Shows how these revolutions in thought lead to philosophical consequences Provides extended case studies of Copernicanism, Darwinism, and Freudianism Integrates the history of science and the*

philosophy of science like no other text Covers both the philosophy of natural and social science in one volume **History and Evolution of Concepts in Physics Springer Science & Business Media** *Our understanding of nature, and in particular of physics and the laws governing it, has changed radically since the days of the ancient Greek natural philosophers. This book explains how and why these changes occurred, through landmark experiments as well as theories that - for their time - were revolutionary. The presentation covers Mechanics, Optics, Electromagnetism, Thermodynamics, Relativity Theory, Atomic Physics and Quantum Physics. The book places emphasis on ideas and on a qualitative presentation, rather than on mathematics and equations. Thus, although primarily addressed to those who are studying or have studied science, it can also be read by non-specialists. The author concludes with a discussion of the evolution and organization of universities, from ancient times until today, and of the organization and dissemination of knowledge through scientific publications and conferences.* **The Material Realization of Science From Habermas to Experimentation and Referential Realism Springer Science & Business Media** *This book develops a conception of science as a multi-dimensional practice, which includes experimental action and production, conceptual-theoretical interpretation, and formal-mathematical work. On this basis, it addresses the topical issue of scientific realism and expounds a detailed, referentially realist account of the natural sciences. This account is shown to be compatible with the frequent occurrence of conceptual discontinuities in the historical development of the sciences. Referential realism exploits several fruitful ideas of Jürgen Habermas, especially his distinction between objectivity and truth; it builds on a in-depth analysis of scientific experiments, including their material realization; and it is developed through an extensive case study in the history and philosophy of quantum mechanics. The new postscript explains how the book relates to several important issues in recent philosophy of science and science studies. "I highly recommend this book. Radder is probably the first philosopher of science to make productive epistemological use of the notion of 'experimental system'. The postscript is most valuable since it connects his work not only to the topical debates in philosophy of science, but also to history of science and science studies." Hans-Jörg Rheinberger, Max Planck Institute for the History of Science, Berlin About the first edition: "The debate on realism has recently become rather stale by repetition, but Radder introduces original insights and has written a lively and well-argued contribution to it. The book is to be recommended also as a clear introduction to the complex of relevant issues." Mary Hesse, University of Cambridge "Radder presents an ingenious approach to the issue of scientific realism and conceptual discontinuity. I believe his idea that conceptual discontinuity presupposes other types of continuity is extremely important." Mark Rowlands, University of Alabama, Tuscaloosa Hans Radder is professor of philosophy of science and technology at VU University Amsterdam. He is the author of In and About the World and The World Observed/The World Conceived. He edited The Philosophy of Scientific Experimentation and The Commodification of Academic Research: Science and the Modern University, and is coeditor of Science Transformed? Debating Claims of an Epochal Break.* **Interpreting Physics Language and the Classical/Quantum Divide Springer Science & Business Media** *This book is the first to offer a systematic account of the role of language in the development and interpretation of physics. An historical-conceptual analysis of the co-evolution of mathematical and physical concepts leads to the classical/quatum interface. Bohrian orthodoxy stresses the indispensability of classical concepts and the functional role of mathematics. This book analyses ways of extending, and then going beyond this orthodoxy orthodoxy. Finally, the book analyzes how a revised interpretation of physics impacts on basic philosophical issues: conceptual revolutions, realism, and reductionism.* **The Meaning of the Wave Function Cambridge University Press** *Covering much of the recent debate, this ambitious text provides new, decisive proof of the reality of the wave function.* **Quantum Generations A History of Physics in the Twentieth Century Princeton University Press** *At the end of the nineteenth century, some physicists believed that the basic principles underlying their subject were already known, and that physics in the future would only consist of filling in the details. They could hardly have been more wrong. The past century has seen the rise of quantum mechanics, relativity, cosmology, particle physics, and solid-state physics, among other fields. These subjects have fundamentally changed our understanding of space, time, and matter. They have also transformed daily life, inspiring a technological revolution that has included the development of radio, television, lasers, nuclear power, and computers. In Quantum Generations, Helge Kragh, one of the world's leading historians of physics, presents a sweeping account of these extraordinary achievements of the past one hundred years. The first comprehensive one-volume history of twentieth-century physics, the book takes us from the discovery of X rays in the mid-1890s to superstring theory in the 1990s. Unlike most previous histories of physics, written either from a scientific perspective or from a social and institutional perspective, Quantum Generations combines both approaches. Kragh writes about pure science with the expertise of a trained physicist, while keeping the content accessible to nonspecialists and paying careful attention to practical uses of science, ranging from compact disks to bombs. As a historian, Kragh skillfully outlines the social and economic contexts that have shaped the field in the twentieth century. He writes, for example, about the impact of the two world wars, the fate of physics under Hitler, Mussolini, and Stalin, the role of military research, the emerging leadership of the United States, and the backlash against science that began in the 1960s. He also shows how the revolutionary discoveries of scientists ranging from Einstein, Planck, and Bohr to Stephen Hawking have been built on the great traditions of earlier centuries. Combining a mastery of detail with a sure sense of the broad contours of historical change, Kragh has written a fitting tribute to the scientists who have played such a decisive role in the making of the modern world.* **The Quantum Divide Why Schrödinger's Cat is Either Dead Or Alive Oxford University Press** *We describe, and provide the quantum mechanical explanation of, a number of well-chosen illustrative modern (mostly optical) experiments that highlight the strange world of the quantum. The view of the world offered by quantum mechanics is shown to be counterintuitive and strikingly at odds with the common sense view of the world of everyday life and classical physics. We address in what sense these different points of view can be reconciled.* **The Bloomsbury Companion to the Philosophy of Science A&C Black** *The Bloomsbury Companion to the Philosophy of Science presents a practical and up-to-date research resource to the philosophy of science. Addressing fundamental questions asked by areas that have continued to attract interest historically, as well as recently-emerging areas of research, this volume provides a comprehensive and up-to-date overview of the philosophy of science. Specially-commissioned essays from an international team of experts reveal where important work continues to be done in the area and the exciting new directions the field is taking. The Companion explores issues pertaining to the philosophy of specific sciences (physics, biology, neuroscience, economics, chemistry and mathematics) and general issues in the field, such as explanation, realism,*

representation, evidence, reduction, laws, causation and confirmation. Featuring a series of indispensable research tools, including an A to Z of key terms and concepts, a chronology, a detailed list of resources and a fully annotated bibliography, The Bloomsbury Companion to the Philosophy of Science the essential reference tool for anyone working in philosophy of science today. **Twentieth-Century Philosophy of Science: A History (Third Edition) Thomas J. Hickey** *History of twentieth-century philosophy of science opens with an introduction to contemporary philosophy of science as of the beginning of the twenty-first century, and describes the new specialty of computational philosophy of science. Seven chapters describing the philosophies of several major philosophers of science follow this introductory chapter. These major philosophers include Ernst Mach and Pierre Duhem, Rudolf Carnap and Willard Van Quine, Werner Heisenberg, Karl Popper, Thomas Kuhn and Paul Feyerabend, Norwood Russell Hanson, and Paul Thagard and Herbert Simon. The book concludes with a large bibliography.* **Entanglement, Information, and the Interpretation of Quantum Mechanics Springer Science & Business Media** *Entanglement was initially thought by some to be an oddity restricted to the realm of thought experiments. However, Bell's inequality delimiting local - havior and the experimental demonstration of its violation more than 25 years ago made it entirely clear that non-local properties of pure quantum states are more than an intellectual curiosity. Entanglement and non-locality are now understood to ?gure prominently in the microphysical world, a realm into which technology is rapidly hurtling. Information theory is also increasingly recognized by physicists and philosophers as intimately related to the foun- tions of mechanics. The clearest indicator of this relationship is that between quantum information and entanglement. To some degree, a deep relationship between information and mechanics in the quantum context was already there to be seen upon the introduction by Max Born and Wolfgang Pauli of the idea that the essence of pure quantum states lies in their provision of probabilities regarding the behavior of quantum systems, via what has come to be known as the Born rule. The signi?cance of the relationship between mechanics and information became even clearer with Leo Szilard's analysis of James Clerk Maxwell's infamous demon thought experiment. Here, in addition to examining both entanglement and quantum infor- tion and their relationship, I endeavor to critically assess the in?uence of the study of these subjects on the interpretation of quantum theory.* **Beyond Measure Modern Physics, Philosophy, and the Meaning of Quantum Theory Oxford University Press on Demand** *Quantum theory is one the most important and successful theories of modern physical science. It has been estimated that its principles form the basis for about 30 per cent of the world's manufacturing economy. This is all the more remarkable because quantum theory is a theory that nobody understands. The meaning of Quantum Theory introduces science students to the theory's fundamental conceptual and philosophical problems, and the basis of its non-understandability. It does this with the barest minimum of jargon and very little mathematics in the main text. Readers wishing to delve more deeply into the theory's mathematical subtleties can do so in an extended series of appendices. The book brings the reader up to date with the results of new experimental tests of quantum weirdness and reviews the latest thinking on alternative interpretations, the frontiers of quantum cosmology, quantum gravity and potential application of this weirdness in computing, cryptography and teleportation.* **Epistemology and Probability Bohr, Heisenberg, Schrödinger, and the Nature of Quantum-Theoretical Thinking Springer Science & Business Media** *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.* **Writings on Physics and Philosophy Springer Science & Business Media** *Wolfgang Pauli was not only a Nobel laureate and one of the creators of modern physics, but also eminent philosopher of modern science. In his essays he writes about space, time and causality, symmetry and the exclusion principle, but also about the role of the unconscious in modern science.* **The Quantum Story A history in 40 moments OUP Oxford** *The twentieth century was defined by physics. From the minds of the world's leading physicists there flowed a river of ideas that would transport mankind to the pinnacle of wonderment and to the very depths of human despair. This was a century that began with the certainties of absolute knowledge and ended with the knowledge of absolute uncertainty. It was a century in which physicists developed weapons with the capacity to destroy our reality, whilst at the same time denying us the possibility that we can ever properly comprehend it. Almost everything we think we know about the nature of our world comes from one theory of physics. This theory was discovered and refined in the first thirty years of the twentieth century and went on to become quite simply the most successful theory of physics ever devised. Its concepts underpin much of the twenty-first century technology that we have learned to take for granted. But its success has come at a price, for it has at the same time completely undermined our ability to make sense of the world at the level of its most fundamental constituents. Rejecting the fundamental elements of uncertainty and chance implied by quantum theory, Albert Einstein once famously declared that 'God does not play dice'. Niels Bohr claimed that anybody who is not shocked by the theory has not understood it. The charismatic American physicist Richard Feynman went further: he claimed that nobody understands it. This is quantum theory, and this book tells its story. Jim Baggott presents a celebration of this wonderful yet wholly disconcerting theory, with a history told in forty episodes — significant moments of truth or turning points in the theory's development. From its birth in the porcelain furnaces used to study black body radiation in 1900, to the promise of stimulating new quantum phenomena to be revealed by CERN's Large Hadron Collider over a hundred years later, this is the extraordinary story of the quantum world. Oxford Landmark Science books are 'must-read' classics of modern science writing which have crystallized big ideas, and shaped the way we think.* **Meeting the Universe Halfway Quantum Physics and the Entanglement of Matter and**

Meaning Duke University Press *A theoretical physicist and feminist theorist, Karen Barad elaborates her theory of agential realism, a schema that is at once a new epistemology, ontology, and ethics.*