The Quantum Measurement Problem Volume 1 Progress

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Quantum Optics, Experimental Gravity, and Measurement Theory Springer Science & Business Media
Volume 7 is a direct continuation of Volume 6, which documented the birth of the complementarity argument and its earliest elaborations. It covers the extension and refinement of the complementarity argument from 1933 until Bohrs' death in 1962. All Bohr's publications on the subject, together with selected manuscripts and extracts of his correspondence with friends and fellow pioneers such as Werner Heisenberg and Wolfgang Pauli, are included. Divided into two, largely independent parts, the volume begins with Bohr's contributions to "Relativistic Quantum Theory". Together with Léon Rosenfeld, Bohr undertook a thorough investigation of the measuring problem in quantum electrodynamics and demonstrated the full accordance between the formalism and the result of idealized thought experiments. The articles in the second part, although also restricted in scope to the field of physics, address a broader audience. One of the most impressive treatises is Bohr's own account of his debates with Albert Einstein, over more than twenty years, on the consistency, the completeness and the epistemological consequences of quantum mechanics. Volumes 6 and 7 of the Collected Works are in turn related to the forthcoming Volume 10 which broadens the scope by presenting Bohr's applications of the complementarity argument beyond the domain of physics. Although each volume may be read independently, careful attention should be paid to the interrelationships between each volume in order to appreciate the subtlety of Bohr's continued elaboration and fine-tuning of his complementarity argument.
Quantum Foundations, Probability and Information Springer Science & Business Media
This volume contains the proceedings of the NATO Advanced Research Workshop on `Quantum Chaos -- Theory and Experiment', held at the Niels Bohr Institute, University of Copenhagen, from 28 May to 1 June 1991. The work brings together leading quantum chaos theorists and experimentalists and greatly improves our understanding of the physics of quantum systems whose classical limit is chaotic. Quantum chaos is a subject of considerable current interest in a variety of fields, in particular nuclear physics, chemistry, statistical mechanics, atomic physics, condensed matter physics and nonlinear dynamics. The volume contains lectures about the currently most active fronts of quantum chaos, such as scars, semiclassical methods, quantum diffusion, random matrix spectra, quantum chaos in atomic and nuclear physics, and possible implications of quantum chaos for the problem of quantum measurement. Part of the book -- The Physics of Quantum Measurements -- is dedicated to the memory of John Bell.
Time in Quantum Mechanics - Vol. 2 Springer
International Series in Natural Philosophy, Volume 30: Problems in Quantum Mechanics focuses on the processes, principles, reactions, and methodologies involved in quantum mechanics. The publication first elaborates on the mathematical formalism of quantum mechanics, simple

quantum systems, and mean values and uncertainty relations. Discussions focus on mean values of dynamical variables, uncertainty relations, eigenfunctions and the energy spectrum, motion in a central field, matrix representation of vectors and operators, Hubert spaces, and operators in Hilbert space. The text then takes a look at mean values and uncertainty relations, semi-classical approximation, and pictures and representations. The book takes a look at orbital angular momentum and spin, systems of identical particles, and perturbation theory. Topics include variational method, stationary state perturbation theory, isotopic spin, second quantization, properties of angular momentum operators, and angular momentum and rotations of coordinate axes. The manuscript also ponders on functions used in quantum mechanics, relativistic quantum mechanics, and radiation theory. The publication is a dependable reference for researchers interested in quantum mechanics.

Foundations of Quantum Theory BoD – Books on Demand

This is a book about the Hilbert space formulation of quantum mechanics and its measurement theory. It contains a synopsis of what became of the Mathematical Foundations of Quantum Mechanics since von Neumann's classic treatise with this title. Fundamental non-classical features of quantum mechanics—indeterminacy and incompatibility of observables, unavoidable measurement disturbance, entanglement, nonlocality—are explicated and analysed using the tools of operational quantum theory. The book is divided into four parts: 1. Mathematics provides a systematic exposition of the Hilbert space and operator theoretic tools and relevant measure and integration theory leading to the Naimark and Stinespring dilation theorems; 2. Elements develops the basic concepts of quantum mechanics and measurement theory with a focus on the notion of approximate joint measurability; 3. Realisations offers in-depth studies of the fundamental observables of quantum mechanics and some of their measurement implementations; and 4. Foundations discusses a selection of foundational topics (quantum-classical contrast, Bell nonlocality, measurement limitations, measurement problem, operational axioms) from a measurement theoretic perspective. The book is addressed to physicists, mathematicians and philosophers of physics with an interest in the mathematical and conceptual foundations of quantum physics, specifically from the perspective of measurement theory.

Quantum Measurement Springer Nature

"I re-experience once again the stimulating atmosphere of each of the ISQMs: There were theoretical discussions in diverse frontier areas of physics as well as descriptions of beautiful new (or planned) experiments and technologies. From each of the Symposia I always came away with the exciting feeling of how wonderful physics is and how lucky it is to be a physicist in this era."Chen Ning YangThis volume is selected from the First through Fourth International Symposia on Foundations of Quantum Mechanics. The International Symposia on Foundations of Quantum Mechanics in the Light of New Technology (ISQMs) provide a unique interdisciplinary forum where distinguished theorists and experimentalists of diverse fields of research gather to discuss basic problems in quantum mechanics in the light of new technology. This volume collects 51 papers selected from over 200 papers by many distinguished scientists. It includes articles by C N Yang, J A Wheeler, Y Nambu, L Esaki and M P A Fisher, to name just a few, and contains topics ranging from quantum measurements to quantum cosmology.

Quantum Mechanics Courier Corporation

This edited volume examines aspects of the mind/consciousness that are relevant to the interpretations of quantum mechanics. In it, an international group of contributors focus on the possible connections between quantum mechanics and consciousness. They look at how consciousness can help us with quantum mechanics as well as how quantum mechanics can contribute to our understanding of consciousness. For example, what do different interpretations aimed at solving the measurement problem in quantum mechanics tell us about the nature of consciousness, such as von Neumann's interpretation? Each interpretation has, associated to it, a corresponding metaphysical framework that helps us think about possible "models" of consciousness. Alternatively, what does the nature of consciousness tell us about the role of the observer and time reversibility in the measurement process? The book features 20 papers on contemporary approaches to quanta and mind. It brings together the work of scholars from different disciplines with diverse views on the connections between quanta and mind, ranging from those who are supportive of a link between consciousness and quantum physics to those who are very skeptical of such link. Coverage includes such topics as free will in a quantum world, contextuality and causality, mind and matter interaction, quantum panpsychism, the quantum and quantum-like brain, and the role of time in brain-mind dynamics.

Logic and Probability in Quantum Mechanics Springer Science & Business Media

This two-volume set can be naturally divided into two semester courses, and contains a full modern graduate course in quantum physics. The idea is to teach graduate students how to practically use quantum physics and theory, presenting the fundamental knowledge, and gradually moving on to applications, including atomic, nuclear and solid state physics, as well as modern subfields, such as quantum chaos and quantum entanglement. The book starts with basic quantum problems, which do not require full quantum formalism but allow the student to gain the necessary experience and elements of quantum thinking. Only then does the fundamental Schrodinger equation appear. The author has included topics that are not usually covered in standard textbooks and has written the book in such a way that every topic contains varying layers of difficulty, so that the instructor can decide where to stop. Although supplementary sources are not required, "Further reading" is given for each chapter, including references to scientific journals and publications, and a glossary is also provided. Problems and solutions are integrated throughout the text.

Problems in Quantum Mechanics Cambridge University Press

This volume contains the Proceedings of the NATO Advanced Study Institute "Quantum Optics and Experimental General Relativity" which was held in Bad Windsheim, Federal Republic of Germany, from August 16 to 29, 1981. At first glance, one might wonder why a meeting should cover these two topics, and a good bit of quantum measurement theory as well, all of which seem to be completely unrelated. The key to what one may call this grand unification lies in the effort, underway in a number of laboratories around the world, to detect gravitational radiation. Present research is pursuing the development of two types of detectors: laser interferometers and resonant bar detectors. Be cause the signals that one is trying to measure are so weak the quan tum mechanical nature of the detectors comes into play. The analy sis of the effects which result from this is facilitated by the use of techniques which have been developed in quantum optics over the years. This analysis also forces one to confront certain issues in the quantum theory of measurement. The laser interferometer detectors, using as they do light, are clearly within the realm of subjects usually considered by quantum optics. For example, the analysis of the noise present in such a de tector can make use of the many techniques which have been developed in quantum optics.

Quantum Mechanics, Volume 1 Springer Science & Business Media

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.

Reality and Measurement in Algebraic Quantum Theory Springer

This volume contains the proceedings of the NATO Advanced Research Workshop on `Quantum Chaos -- Theory and Experiment', held at the Niels Bohr Institute, University of Copenhagen, from 28 May to 1 June 1991. The work brings together leading quantum chaos theorists and experimentalists and greatly improves our understanding of the physics of quantum systems whose classical limit is chaotic. Quantum chaos is a subject of considerable current interest in a variety of fields, in particular nuclear physics, chemistry, statistical mechanics, atomic physics, condensed matter physics and nonlinear dynamics. The volume contains lectures about the currently most active fronts of quantum chaos, such as scars, semiclassical methods, quantum diffusion, random matrix spectra, quantum chaos in atomic and nuclear physics, and possible implications of quantum chaos for the problem of quantum measurement. Part of the book -- The Physics of Quantum Measurements -- is dedicated to the memory of John Bell.

Quantum Mechanics and the Measurement Problem World Scientific

During the academic years 1972-1973 and 1973-1974, an intensive sem inar on the foundations of quantum mechanics met at Stanford on a regular basis. The extensive exploration of ideas in the seminar led to the org~ization of a double issue of Synthese concerned with the foundations of quantum mechanics, especially with the role of logic and probability in quantum meChanics. About half of the articles in the volume grew out of this seminar. The remaining articles have been so licited explicitly from individuals who are actively working in the foun dations of quantum mechanics. Seventeen of the twenty-one articles appeared in Volume 29 of Syn these. Four additional articles and a bibliography on -the history and philosophy of quantum mechanics have been added to the present volume. In particular, the articles by Bub, Demopoulos, and Lande, as well as the second article by Zanotti and myself, appear for the first time in the present volume. In preparing the articles for publication I am much indebted to Mrs. Lillian O'Toole, Mrs. Dianne Kanerva, and Mrs. Marguerite Shaw, for their extensive assistance.

Quantum Measurement and Control Springer Science & Business Media

This book, the first in a two-volume set, provides an introduction to the fundamentals of (mainly) non-relativistic quantum mechanics. This first volume chiefly focuses on the essential principles, while applications and extensions of the formalism can be found in volume 2. Including but also moving beyond material that is covered in traditional textbooks on quantum mechanics, the book discusses in detail current issues such as interaction-free quantum measurements or neutrino oscillations, as well as fundamental problems and epistemological questions, such as the measurement problem. A chapter on the postulates of quantum mechanics rounds off this first volume. In order to quickly and clearly present the main principles of quantum mechanics and its mathematical formulation, there is a systematic transition between wave mechanics and algebraic representation in the first few chapters, in which the required mathematical tools are introduced step by step. Moreover, the appendix concisely reviews the most important mathematical tools, allowing readers to largely dispense with supplementary literature. The appendix also explores advanced topics, such as the Quantum-Zeno effect and time-delay experiments. Over 250 exercises, most of them with solutions, help to deepen the reader's understanding of the topics discussed. This revised second edition is expanded by an introduction to some ideas and problems of relativistic quantum mechanics. In this first volume, the Klein-Gordon and the Dirac equations are treated. Fundamentals of other areas are compiled in compact form, i.e., outlines of special relativity, classical field theory and electrodynamics. The book is chiefly intended for student science teachers and all students of physics, majors and minors alike, who are looking for a reasonably easy and modern introduction to quantum mechanics.

Physical Theory and its Interpretation Hermann

Quantum Mechanics: Problems with Solutions contains detailed model solutions to the exercise problems formulated in the companion Lecture Notes volume. In many cases, the solutions include result discussions that enhance the lecture material. For readers' convenience, the problem assignments are reproduced in this volume.

Quantum Worlds Springer

This book treats various aspects of the quantum theory of measurement, partially in a relativistic framework. Measurement(-like) processes in quantum theory are identified and analysed; and the quantum operator formalism is derived in full generality without postulating operators as observables. Consistency conditions are derived, expressing the requirement of Lorentz-frame independence of outcomes of spacelike separated measurements and implying the impossibility of using quantum nonlocality to send signals faster than light. Local commutativity is scrutinized. The localization problem of relativistic quantum theory is studied, including comprehensive derivation of the theorems of Hegerfeld, Malament and Reeh-Schlieder. Finally, the quantum formalism is derived from the dynamics of particles with definite positions in Bohmian mechanics.

Local Quantum Measurement and Relativity Springer

But all the clocks in the city Began to whirr and chime: 'O let not Time deceive you, You cannot conquer Time. W. H. Auden It is hard to think of a subject as rich, complex, and important as time. From the practical point of view it governs and organizes our lives (most of us are after all attached to a wrist watch) or it helps us to wonderfully ?nd our way in unknown territory with the global positioning system (GPS). More generally it constitutes the heartbeat of modern technology. Time is the most precisely measured quantity, so the second de?nes the meter or the volt and yet, nobody knows for sure what it is, puzzling philosophers, artists, priests, and scientists for centuries as one of the enduring enigmas of all cultures. Indeed time

is full of contrasts: taken for granted in daily life, it requires sophisticated experimental and theoretical treatments to be accurately “produced. ” We are trapped in its web, and it actually kills us all, but it also constitutes the stuff we need to progress and realize our objectives. There is nothing more boring and monotonous than the tick-tock of a clock, but how many fascinating challenges have physicists met to realize that monotony: Quite a number of Nobel Prize winners have been directly motivated by them or have contributed 1 signi?cantly to time measurement.

Quanta and Mind Elsevier

John von Neumann (1903-1957) was undoubtedly one of the scientific geniuses of the 20th century. The main fields to which he contributed include various disciplines of pure and applied mathematics, mathematical and theoretical physics, logic, theoretical computer science, and computer architecture. Von Neumann was also actively involved in politics and science management and he had a major impact on US government decisions during, and especially after, the Second World War. There exist several popular books on his personality and various collections focusing on his achievements in mathematics, computer science, and economy. Strangely enough, to date no detailed appraisal of his seminal contributions to the mathematical foundations of quantum physics has appeared. Von Neumann's theory of measurement and his critique of hidden variables became the touchstone of most debates in the foundations of quantum mechanics. Today, his name also figures most prominently in the mathematically rigorous branches of contemporary quantum mechanics of large systems and quantum field theory. And finally - as one of his last lectures, published in this volume for the first time, shows - he considered the relation of quantum logic and quantum mechanical probability as his most important problem for the second half of the twentieth century. The present volume embraces both historical and systematic analyses of his methodology of mathematical physics, and of the various aspects of his work in the foundations of quantum physics, such as theory of measurement, quantum logic, and quantum mechanical entropy. The volume is rounded off by previously unpublished letters and lectures documenting von Neumann's thinking about quantum theory after his 1932 Mathematical Foundations of Quantum Mechanics. The general part of the Yearbook contains papers emerging from the Institute's annual lecture series and reviews of important publications of philosophy of science and its history.

Bell's Theorem, Quantum Theory and Conceptions of the Universe World Scientific

Modern quantum measurement for graduate students and researchers in quantum information, quantum metrology, quantum control and related fields.

The Measurement Problem in Quantum Mechanics Springer

Offers a comprehensive and up-to-date volume on the conceptual and philosophical problems related to the interpretation of quantum mechanics.

The Quantum Theory of Measurement Iph001

"Strongly recommended" by the American Journal of Physics, this volume serves as a text for advanced undergraduates and graduate students of physics as well as a reference for professionals. Clear in its presentation and scrupulous in its attention to detail, the treatment originally appeared in a two-volume French edition. This convenient single-volume translation begins with formalism and its interpretation, starting with the origins of quantum theory and examinations of matter waves and the Schrödinger equation, one-dimensional quantized systems, the uncertainty relations, and the mathematical framework and physical content of formalism. The second half opens with an exploration of symmetries and invariance, including a consideration of angular momentum, identical particles and the Pauli exclusion principle, invariance and conservation laws, and time reversal. Methods of approximation include those involving stationary perturbations, the equation of motion, variational method, and collision theory. The final chapters review the elements of relativistic quantum mechanics, and each of the two volumes concludes with useful appendixes.

Measurements in Quantum Mechanics John Wiley & Sons

This new edition of the unrivalled textbook introduces the fundamental concepts of quantum mechanics such as waves, particles and probability before explaining the postulates of quantum mechanics in detail. In the proven didactic manner, the textbook then covers the classical scope of introductory quantum mechanics, namely simple two-level systems, the one-dimensional harmonic oscillator, the quantized angular momentum and particles in a central potential. The entire book has been revised to take into account new developments in quantum mechanics curricula. The textbook retains its typical style also in the new edition: it explains the fundamental concepts in chapters which are elaborated in accompanying complements that provide more detailed discussions, examples and applications. * The quantum mechanics classic in a new edition: written by 1997 Nobel laureate Claude Cohen-Tannoudji and his colleagues Bernard Diu and Franck Laloë * As easily comprehensible as possible: all steps of the physical background and its mathematical representation are spelled out explicitly * Comprehensive: in addition to the fundamentals themselves, the book contains more than 350 worked examples plus exercises Claude Cohen-Tannoudji was a researcher at the Kastler-Brossel laboratory of the Ecole Normale Supérieure in Paris where he also studied and received his PhD in 1962. In 1973 he became Professor of atomic and molecular physics at the Collège des France. His main research interests were optical pumping, quantum optics and atom-photon interactions. In 1997, Claude Cohen-Tannoudji, together with Steven Chu and William D. Phillips, was awarded the Nobel Prize in Physics for his research on laser cooling and trapping of neutral atoms. Bernard Diu was Professor at the Denis Diderot University (Paris VII). He was engaged in research at the Laboratory of Theoretical Physics and High Energy where his focus was on strong interactions physics and statistical mechanics. Franck Laloë was a researcher at the Kastler-Brossel laboratory of the Ecole Normale Supérieure in Paris. His first assignment was with the University of Paris VI before he was appointed to the CNRS, the French National Research Center. His research was focused on optical pumping, statistical mechanics of quantum gases, musical acoustics and the foundations of quantum mechanics.