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KEY=THEORY - JADA HOWELL

DECOHERENCE AND THE APPEARANCE OF A CLASSICAL WORLD IN QUANTUM THEORY

Springer Science & Business Media A unique description of the phenomena that arise from the interaction between quantum systems and their environment. Because of the novel character of the approach discussed, the book addresses scientists from all fields of physics and related disciplines as well as students of physics.

DECOHERENCE

AND THE QUANTUM-TO-CLASSICAL TRANSITION

Springer Science & Business Media This detailed, accessible introduction to the field of quantum decoherence reviews the basics and then explains the essential consequences of the phenomenon for our understanding of the world. The discussion includes, among other things: How the classical world of our experience can emerge from quantum mechanics; the implications of decoherence for various interpretations of quantum mechanics; recent experiments confirming the puzzling consequences of the quantum superposition principle and making decoherence processes directly observable.

THE PHYSICAL BASIS OF THE DIRECTION OF TIME

Springer Science & Business Media This book arose from a series of lectures which I gave at the University of Heidelberg during the summer terms of 1979,1982 and 1986. They led in 1984 the publication in German of Die Physik der Zeitrichtung, which appeared to as Vol. 200 of the Springer Lecture Notes in Physics. The present English version is not merely a translation of these notes, but has been widely revised and extended. The number of changes and additions roughly increases with chapter number. Chaps. 5 and 6 have been completely rewritten (except for Sect. 5. 1, which is a revised version of the former § 5. 2). The new title is intended to express the somewhat more ambitious program of this book as compared to its German predecessor. My interest in this subject stemmed originally from an attempt to place the quantum mechanical measurement process in its proper relation to other irreversible phenomena. It soon became evident that statistical thermody namics is too limited for the search for the common roots of the obviously related arrows of time. It is precisely the interconnectedness of many areas of physics, and not least their relation to some fundamental concepts (or per haps prejudices) of epistemology, which sustained my fascination with the subject of this book over many years. Thus it was not my intention to de scribe technicalities or mathematical problems, but to point out the essential physical ideas (which are often overlooked).

ENSEMBLES ON CONFIGURATION SPACE

CLASSICAL, QUANTUM, AND BEYOND

Springer This book describes a promising approach to problems in the foundations of quantum mechanics, including the measurement problem. The dynamics of ensembles on configuration space is shown here to be a valuable tool for unifying the formalisms of classical and quantum mechanics, for deriving and extending the latter in various ways, and for addressing the quantum measurement problem. A description of physical systems by means of ensembles on configuration space can be introduced at a very fundamental level: the basic building blocks are a configuration space, probabilities, and Hamiltonian equations of motion for the probabilities. The formalism can describe both classical and quantum systems, and their thermodynamics, with the main difference being the choice of ensemble Hamiltonian. Furthermore, there is a natural way of introducing ensemble Hamiltonians that describe the evolution of hybrid systems; i.e., interacting systems that have distinct classical and quantum sectors, allowing for consistent descriptions of quantum systems interacting with classical measurement devices and quantum matter fields interacting gravitationally with a classical spacetime.

QUANTUM DECOHERENCE

POINCARÉ SEMINAR 2005

Springer Science & Business Media This volume is devoted to Quantum Decoherence with lectures from the Séminaire Poincaré, held in November 2005 at the Institute Henri Poincaré Paris. The goal of this seminar is to provide up-to-date information about general topics of great interest in physics. Both the theoretical and experimental results are covered, with some historical background. Particular care is devoted to the pedagogical nature of the presentation.

QUANTUM MEASUREMENTS AND DECOHERENCE

MODELS AND PHENOMENOLOGY

Springer Science & Business Media Quantum measurement (Le., a measurement which is sufficiently precise for quantum effects to be essential) was always one of the most impor tant points in quantum mechanics because it most evidently revealed the difference between quantum and classical physics. Now quantum measure ment is again under active investigation, first of all because of the practical necessity of dealing with highly precise and complicated measurements. The nature of quantum measurement has become understood much bet ter during this new period of activity, the understanding being expressed by the concept of decoherence. This term means a physical process lead ing from a pure quantum state (wave function) of the system prior to the measurement to its state after the measurement which includes classical elements. More concretely, decoherence occurs as a result of the entangle ment of the measured system with its environment and results in the loss of phase relations between components of the wave function of the measured system. Decoherence is essentially nothing else than quantum measurement, but considered from the point of view of its physical mechanism and resolved in time. The present book is devoted to the two concepts of quantum measure ment and decoherence and to their interrelation, especially in the context of continuous quantum measurement.

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.

FROM QUANTUM TO CLASSICAL

ESSAYS IN HONOUR OF H.-DIETER ZEH

Springer Nature

ELEGANCE AND ENIGMA

THE QUANTUM INTERVIEWS

Springer Science & Business Media Quantum mechanics is one of mankind's most remarkable intellectual achievements. Stunningly successful and elegant, it challenges our deepest intuitions about the world. In this book, seventeen physicists and philosophers, all deeply concerned with understanding quantum mechanics, reply to Schlosshauer's penetrating questions about the central issues. They grant us an intimate look at their radically different ways of making sense of the theory's strangeness. What is quantum mechanics about? What is it telling us about nature? Can quantum information or new experiments help lift the fog? And where are we headed next? Everyone interested in the contemporary but often longstanding conundrums of quantum theory, whether lay reader or expert, will find much food for thought in these pages. A wealth of personal reflections and anecdotes guarantee an engaging read. Participants: Guido Bacciagaluppi, Caslav Brukner, Jeffrey Bub, Arthur Fine, Christopher Fuchs, GianCarlo Ghirardi, Shelly Goldstein, Daniel Greenberger, Lucien Hardy, Anthony Leggett, Tim Maudlin, David Mermin, Lee Smolin, Antony Valentini, David Wallace, Anton Zeilinger, and Wojciech Zurek.

THE THEORY OF OPEN QUANTUM SYSTEMS

Oxford University Press on Demand This book treats the central physical concepts and mathematical techniques used to investigate the dynamics of open quantum systems. To provide a self-contained presentation the text begins with a survey of classical probability theory and with an introduction into the foundations of quantum mechanics with particular emphasis on its statistical interpretation. The fundamentals of density matrix theory, quantum Markov processes and dynamical semigroups are developed. The most important master equations used in quantum optics and in the theory of quantum Brownian motion are applied to the study of many examples. Special attention is paid to the theory of environment induced decoherence, its role in the dynamical description of the measurement

process and to the experimental observation of decohering Schrodinger cat states. The book includes the modern formulation of open quantum systems in terms of stochastic processes in Hilbert space. Stochastic wave function methods and Monte Carlo algorithms are designed and applied to important examples from quantum optics and atomic physics, such as Levy statistics in the laser cooling of atoms, and the damped Jaynes-Cummings model. The basic features of the non-Markovian quantum behaviour of open systems are examined on the basis of projection operator techniques. In addition, the book expounds the relativistic theory of quantum measurements and discusses several examples from a unified perspective, e.g. non-local measurements and quantum teleportation. Influence functional and super-operator techniques are employed to study the density matrix theory in quantum electrodynamics and applications to the destruction of quantum coherence are presented. The text addresses graduate students and lecturers in physics and applied mathematics, as well as researchers with interests in fundamental questions in quantum mechanics and its applications. Many analytical methods and computer simulation techniques are developed and illustrated with the help of numerous specific examples. Only a basic understanding of quantum mechanics and of elementary concepts of probability theory is assumed.

UNDERSTANDING QUANTUM MECHANICS

Princeton University Press Here Roland Omnès offers a clear, up-to-date guide to the conceptual framework of quantum mechanics. In an area that has provoked much philosophical debate, Omnès has achieved high recognition for his Interpretation of Quantum Mechanics (Princeton 1994), a book for specialists. Now the author has transformed his own theory into a short and readable text that enables beginning students and experienced physicists, mathematicians, and philosophers to form a comprehensive picture of the field while learning about the most recent advances. This new book presents a more streamlined version of the Copenhagen interpretation, showing its logical consistency and completeness. The problem of measurement is a major area of inquiry, with the author surveying its history from Planck to Heisenberg before describing the consistent-histories interpretation. He draws upon the most recent research on the decoherence effect (related to the modern resolution of the famous Schrödinger's cat problem) and an exact formulation of the correspondence between quantum and particle physics (implying a derivation of classical determinism from quantum probabilism). Interpretation is organized with the help of a universal and sound language using so-called consistent histories. As a language and a method, it can now be shown to be free of ambiguity and it makes interpretation much clearer and closer to common sense.

QUANTUM COMPUTATION AND QUANTUM INFORMATION

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

information.

THE INTERPRETATION OF QUANTUM MECHANICS

Princeton University Press The interpretation of quantum mechanics has been controversial since the introduction of quantum theory in the 1920s. Although the Copenhagen interpretation is commonly accepted, its usual formulation suffers from some serious drawbacks. Based mainly on Bohr's concepts, the formulation assumes an independent and essential validity of classical concepts running in parallel with quantum ones, and leaves open the possibility of their ultimate conflict. In this book, Roland Omnès examines a number of recent advances, which, combined, lead to a consistent revision of the Copenhagen interpretation. His aim is to show how this interpretation can fit all present experiments, to weed out unnecessary or questionable assumptions, and to assess the domain of validity where the older statements apply. Drawing on the new contributions, The Interpretation of Quantum Mechanics offers a complete and self-contained treatment of interpretation (in nonrelativistic physics) in a manner accessible to both physicists and students. Although some "hard" results are included, the concepts and mathematical developments are maintained at an undergraduate level. This book enables readers to check every step, apply the techniques to new problems, and make sure that no paradox or obscurity can arise in the theory. In the conclusion, the author discusses various philosophical implications pertinent to the study of quantum mechanics.

THE SEMICLASSICAL WAY TO DYNAMICS AND SPECTROSCOPY

Princeton University Press A graduate-level text that examines the semiclassical approach to quantum mechanics Physical systems have been traditionally described in terms of either classical or quantum mechanics. But in recent years, semiclassical methods have developed rapidly, providing deep physical insight and computational tools for quantum dynamics and spectroscopy. In this book, Eric Heller introduces and develops this subject, demonstrating its power with many examples. In the first half of the book, Heller covers relevant aspects of classical mechanics, building from them the semiclassical way through the semiclassical limit of the Feynman path integral. The second half of the book applies this approach to various kinds of spectroscopy, such as molecular spectroscopy and electron imaging and quantum dynamical systems with an emphasis on tunneling. Adopting a distinctly time-dependent viewpoint, Heller argues for semiclassical theories from experimental and theoretical vantage points valuable to research in physics and chemistry. Featuring more than two hundred figures, the book provides a geometric, phase-space, and coordinate-space pathway to greater understanding. Filled with practical examples and applications, The Semiclassical Way to Dynamics and Spectroscopy is a comprehensive presentation of the tools necessary to successfully delve into this unique area of quantum mechanics. A

comprehensive approach for using classical mechanics to do quantum mechanics More than two hundred figures to assist intuition Emphasis on semiclassical Green function and wave packet perspective, as well as tunneling and spectroscopy Chapters include quantum mechanics of classically chaotic systems, quantum scarring, and other modern dynamical topics

FOUNDATIONS AND INTERPRETATION OF QUANTUM MECHANICS

IN THE LIGHT OF A CRITICAL-HISTORICAL ANALYSIS OF THE PROBLEMS AND OF A SYNTHESIS OF THE RESULTS

World Scientific The aim of this book is twofold: to provide a comprehensive account of the foundations of the theory and to outline a theoretical and philosophical interpretation suggested from the results of the last twenty years.There is a need to provide an account of the foundations of the theory because recent experience has largely confirmed the theory and offered a wealth of new discoveries and possibilities. On the other side, the following results have generated a new basis for discussing the problem of the interpretation: the new developments in measurement theory; the experimental generation of ?Schr□dinger cats?; recent developments which allow, for the first time, the simultaneous measurement of complementary observables; quantum information processing, teleportation and computation.To accomplish this task, the book combines historical, systematic and thematic approaches.

MODERN CHALLENGES IN QUANTUM OPTICS

SELECTED PAPERS OF THE FIRST INTERNATIONAL MEETING IN QUANTUM OPTICS HELD IN SANTIAGO, CHILE, 13–16 AUGUST 2000

Springer Quantum Optics is a rapidly progressing field well suited to probe the many fundamental issues raised by the subtleties of quantum physics. This book consists of a collection of reviews and papers that highlight the most important challenges faced in this area of research, including topics such as cavity QED, quantum entanglement, decoherence, matter waves and nonlinear optics. It will be a source of reference for all those who wish to familiarize themselves with the latest developments in the field.

BEYOND WEIRD

WHY EVERYTHING YOU THOUGHT YOU KNEW ABOUT QUANTUM PHYSICS IS DIFFERENT

No one can say what quantam mechanics means (and this is a book about it) -- Quantum mechanics is not really about the quantum -- Quantum objects are neither wave nor particle (but sometimes they might as well be) -- Quantum particles aren't in two states at once

(but sometimes they might as well be) -- What "happens" depends on what we find out about it -- There are many ways of interpreting quantum theory (and none of them quite make sense) -- Whatever the question, the answer is "yes" (unless it's "no") -- Not everything is knowable at once -- The properties of quantum objects don't have to be contained within the objects -- There is no "spooky action at a distance"--The everyday world is what quantum becomes at human scales -- Everything you experience is a (partial) copy of what causes it -- Schrödinger's cat has had kittens -- Quantum mechanics can be harnessed for technology -- Quantum computers don't necessarily perform "many calculations at once" -- There is no other "quantum" you -- Things could be even more "quantum" than they are (so why aren't they)? -- The fundamental laws of quantum mechanics might be simpler than we imagine -- Can we ever get to the bottom of it?

COHERENT ATOMIC MATTER WAVES - ONDES DE MATIERE COHERENTES

27 JULY - 27 AUGUST 1999

Springer Science & Business Media This book, devoted to the study of quantum effects in atomic systems, reviews the state of the art in the fields of Bose--Einstein condensation, quantum information processing, and the problems of propagation of matter waves in complex media. The specific topics include: theory and experiments in Bose--Einstein condensation, theory and experiments on decoherence phenomena in simple quantum systems and the connection to quantum measurement, atom interferometry, quantum computing, multiple scattering problems in atomic physics, quantum and nonlinear optics in a photonic band gap and quantum chaos and atomic physics. Pedagogical in style, the articles address PhD students as well as researchers.

ESSENTIAL CLASSICAL MECHANICS FOR DEVICE PHYSICS

Morgan & Claypool Publishers Continued advances in the precision manufacturing of new structures at the nanometer scale have provided unique opportunities for device physics. This book sets out to summarize those elements of classical mechanics most applicable for scientists and engineers studying device physics. Supplementary MATLAB® materials are available for all figures generated numerically.

FUNDAMENTALS OF QUANTUM INFORMATION

QUANTUM COMPUTATION, COMMUNICATION, DECOHERENCE AND ALL THAT

Springer Quantum information science is a rapidly developing field that not only promises a revolution in computer sciences but also

touches deeply the very foundations of quantum physics. This book consists of a set of lectures by leading experts in the field that bridges the gap between standard textbook material and the research literature, thus providing the ne- cessary background for postgraduate students and non-specialist researchers wishing to familiarize themselves with the subject thoroughly and at a high level. This volume is ideally suited as a course book for postgraduate students, and lecturers will find in it a large choice of material for bringing their courses up to date.

ENTANGLEMENT AND DECOHERENCE

FOUNDATIONS AND MODERN TRENDS

Springer Entanglement and (de-)coherence arguably define the central issues of concern in present day quantum information theory. Entanglement being a consequence of the quantum mechanical superposition principle for composite systems, a better understanding of the environment-induced destruction of coherent superposition states is required to devise novel strategies for harvesting quantum interference phenomena. The present book collects a series of advanced lectures on the theoretical foundations of this active research field, from mathematical aspects underlying quantum topology to mesoscopic transport theory. All lectures start out from an elementary level and proceed along a steep learning curve. This makes the material particularly suitable for student seminars on the more fundamental theoretical aspects of quantum information, and equally useful as supplementary reading for advanced lectures on this topic.

CLASSICAL AND QUANTUM INFORMATION

Academic Press A new discipline, Quantum Information Science, has emerged in the last two decades of the twentieth century at the intersection of Physics, Mathematics, and Computer Science. Quantum Information Processing is an application of Quantum Information Science which covers the transformation, storage, and transmission of quantum information; it represents a revolutionary approach to information processing. Classical and Quantum Information covers topics in quantum computing, quantum information theory, and quantum error correction, three important areas of quantum information processing. Quantum information theory and quantum error correction build on the scope, concepts, methodology, and techniques developed in the context of their close relatives, classical information theory and classical error correcting codes. Presents recent results in quantum computing, quantum information theory, and quantum error correcting codes Covers both classical and quantum information theory and error correcting codes The last chapter of the book covers physical implementation of quantum information processing devices Covers the mathematical formalism and the concepts in Quantum Mechanics critical for understanding the properties and the transformations of quantum information

QUANTUM COMMUNICATION, COMPUTING, AND MEASUREMENT 3

Springer Science & Business Media This volume contains contributions based on the lectures delivered and posters presented at the Fifth International Conference on Quantum Communication, Measurement and Computing (QCM&C-Y2K). This Conference is the fifth of a successful series hosted this time in Italy, was held in Capri, 3-7 July, 2000. The conference was attended by more than 200 participants from all over the world. There was also a high level of participation from graduate students, who greatly benefited from the opportunity to attend world-class conferences. The Conference Hall was hosted in La Residenza Hotel in Capri, where part of p- ticipants where housed, while others where housed in various cozy nearby - tels. All enjoyed the pleasant atmosphere offered by the island of Capri. There were 59 invited lectures given as oral presentations of 30 minutes and 94 poster papers. The major topics covered at the Conference where new experimental and theoretical results in quantum information. They were divided in five parts; i) Quantum Information and Communication, ii) Quantum Measurement, - coherence, and Tomography, iii) Quantum Computing, iv) Cryptography, v) Entanglement and Teleportation. We were lucky in that almost all major - perimental groups in the world working in this area were represented, as were the major theoreticians. There was very active audience participation. A n- ber of graduate students and post-docs were able to present their contributions in four after dinner poster sessions.

THE PHYSICAL BASIS OF THE DIRECTION OF TIME

Springer Science & Business Media This thoroughly revised 5th edition of Zeh's classic text investigates irreversible phenomena and their foundation in classical, quantum and cosmological settings. It includes new sections on the meaning of probabilities in a cosmological context, irreversible aspects of quantum computers, and various consequences of the expansion of the Universe. In particular, the book offers an analysis of the physical concept of time.

A CONCISE INTRODUCTION TO QUANTUM MECHANICS

Morgan & Claypool Publishers Assuming a background in basic classical physics, multivariable calculus, and differential equations, A Concise Introduction to Quantum Mechanics provides a self-contained presentation of the mathematics and physics of quantum mechanics. The relevant aspects of classical mechanics and electrodynamics are reviewed, and the basic concepts of wave-particle duality are developed as a logical outgrowth of experiments involving blackbody radiation, the photoelectric effect, and electron diffraction. The Copenhagen interpretation of the wave function and its relation to the particle probability density is presented in conjunction with Fourier analysis and its generalization to function spaces. These concepts are combined to analyze the system consisting of a particle confi ned to a box, developing the probabilistic interpretation of observations and their associated expectation

values. The Schrödinger equation is then derived by using these results and demanding both Galilean invariance of the probability density and Newtonian energy-momentum relations. The general properties of the Schrödinger equation and its solutions are analyzed, and the theory of observables is developed along with the associated Heisenberg uncertainty principle. Basic applications of wave mechanics are made to free wave packet spreading, barrier penetration, the simple harmonic oscillator, the Hydrogen atom, and an electric charge in a uniform magnetic fi eld. In addition, Dirac notation, elements of Hilbert space theory, operator techniques, and matrix algebra are presented and used to analyze coherent states, the linear potential, two state oscillations, and electron diffraction. Applications are made to photon and electron spin and the addition of angular momentum, and direct product multiparticle states are used to formulate both the Pauli exclusion principle and quantum decoherence. The book concludes with an introduction to the rotation group and the general properties of angular momentum.

ENTANGLED WORLD

THE FASCINATION OF QUANTUM INFORMATION AND COMPUTATION

John Wiley & Sons In the quantum world, a particle can behave like a wave and accordingly seems to be in two places at the same time. This of course is contradictory to our daily experiences with classical particles. How then should this be understood? What happens in the transitional area between the classical world and quantum mechanics? The present book answers exciting questions like these in a way that is easy to follow and to understand and is shows that the link between these two worlds will have concrete and applied effects on our daily life in the near future. It will, for example, improve and change the conventional methods of information processing. With the help of quantum cryptography, it will be possible to communicate tap-proof. Using quantum computers we will be able to solve highly complicated problems in a very short time.

QUANTUM COMPUTING SINCE DEMOCRITUS

Cambridge University Press Takes students and researchers on a tour through some of the deepest ideas of maths, computer science and physics.

QUANTUM THEORY: A VERY SHORT INTRODUCTION

OUP Oxford Quantum Theory is the most revolutionary discovery in physics since Newton. This book gives a lucid, exciting, and accessible account of the surprising and counterintuitive ideas that shape our understanding of the sub-atomic world. It does not

disguise the problems of interpretation that still remain unsettled 75 years after the initial discoveries. The main text makes no use of equations, but there is a Mathematical Appendix for those desiring stronger fare. Uncertainty, probabilistic physics, complementarity, the problematic character of measurement, and decoherence are among the many topics discussed. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

QUANTUM WORLDS

PERSPECTIVES ON THE ONTOLOGY OF QUANTUM MECHANICS

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

BOHMIAN MECHANICS, OPEN QUANTUM SYSTEMS AND CONTINUOUS MEASUREMENTS

Springer This book shows how Bohmian mechanics overcomes the need for a measurement postulate involving wave function collapse. The measuring process plays a very important role in quantum mechanics. It has been widely analyzed within the Copenhagen approach through the Born and von Neumann postulates, with later extension due to Lüders. In contrast, much less effort has been invested in the measurement theory within the Bohmian mechanics framework. The continuous measurement (sharp and fuzzy, or strong and weak) problem is considered here in this framework. The authors begin by generalizing the so-called Mensky approach, which is based on restricted path integral through quantum corridors. The measuring system is then considered to be an open quantum system following a stochastic Schrödinger equation. Quantum stochastic trajectories (in the Bohmian sense) and their role in basic quantum processes are discussed in detail. The decoherence process is thereby described in terms of classical trajectories issuing from the violation of the noncrossing rule of quantum trajectories.

HANDBOOK OF APPLICATIONS OF CHAOS THEORY

CRC Press In addition to explaining and modeling unexplored phenomena in nature and society, chaos uses vital parts of nonlinear dynamical systems theory and established chaotic theory to open new frontiers and fields of study. Handbook of Applications of Chaos Theory covers the main parts of chaos theory along with various applications to diverse areas. Expert contributors from around the

world show how chaos theory is used to model unexplored cases and stimulate new applications. Accessible to scientists, engineers, and practitioners in a variety of fields, the book discusses the intermittency route to chaos, evolutionary dynamics and deterministic chaos, and the transition to phase synchronization chaos. It presents important contributions on strange attractors, self-exciting and hidden attractors, stability theory, Lyapunov exponents, and chaotic analysis. It explores the state of the art of chaos in plasma physics, plasma harmonics, and overtone coupling. It also describes flows and turbulence, chaotic interference versus decoherence, and an application of microwave networks to the simulation of quantum graphs. The book proceeds to give a detailed presentation of the chaotic, rogue, and noisy optical dissipative solitons; parhelic-like circle and chaotic light scattering; and interesting forms of the hyperbolic prism, the Poincaré disc, and foams. It also covers numerous application areas, from the analysis of blood pressure data and clinical digital pathology to chaotic pattern recognition to economics to musical arts and research.

THE QUANTUM DIVIDE

WHY SCHRÖDINGER'S CAT IS EITHER DEAD OR ALIVE

OUP Oxford Using a selection of key experiments performed over the past 30 years or so, we present a discussion of the strikingly counter-intuitive phenomena of the quantum world that defy explanation in terms of everyday "common sense" reasoning, and we provide the corresponding quantum mechanical explanations with a very elementary use of associated formalism. Most, but certainly not all, of the experiments we describe are optical experiments involving a very small number of photons (particles of light). We begin with experiments on the wave-particle duality of electrons, proceed to experiments on the particle nature of light and single photon interference, delayed choice experiments and interaction-free detection, then go on to experiments involving the interference of two photons, quantum entanglement and Bell's Theorem, quantum teleportation, large-scale quantum effects and the divide between the classical and quantum worlds, addressing the question as to whether or not there is such a divide.

QUANTUM FOUNDATIONS, PROBABILITY AND INFORMATION

Springer Composed of contributions from leading experts in quantum foundations, this volume presents viewpoints on a number of complex problems through informational, probabilistic, and mathematical perspectives and features novel mathematical models of quantum and subquantum phenomena. Rich with multi-disciplinary mathematical content, this book includes applications of partial differential equations in quantum field theory, differential geometry, oscillatory processes and vibrations, and Feynman integrals for quickly growing potential functions. Due to rapid growth in the field in recent years, this volume aims to promote interdisciplinary collaboration in the areas of quantum probability, information, communication and foundation, and mathematical physics. Many

papers discuss complex yet novel problems that depart from the mainstream of quantum physical studies. Others devote explanation to fundamental problems of the conventional quantum theory, including its mathematical formalism. Overall, authors cover a diverse set of topics, including quantum and classical field theory and oscillatory processing, quantum mechanics from a Darwinian evolutionary perspective, and biological applications of quantum theory. Together in one volume, these essays will be useful to experts in the corresponding areas of quantum theory. Theoreticians, experimenters, mathematicians, and even philosophers in quantum physics and quantum probability and information theory can consider this book a valuable resource.

IRREVERSIBLE QUANTUM DYNAMICS

Springer The idea of editing the present volume in the Lecture Notes in Physics series arosewhileorganizingthe“ConferenceonIrreversibleQuantumDynamics”that took place at The Abdus Salam International Center for Theoretical Physics, Trieste, Italy, from July 29 to August 2, 2002. The aim of the Conference was to bring together di?erent groups of - searcherswhoseinterestsandpursuitsinvolveirreversibilityandtimeasymmetry in quantum mechanics. The Conference promoted open and in-depth exchanges of di?erent points of view, concerning both the content and character of qu- tum irreversibility and the methodologies used to study it. The following main themes were addressed: • Theoretical Aspects of Quantum Irreversible Dynamics • Open Quantum Systems and Applications • Foundational Aspects of Irreversible Quantum Dynamics • Asymmetric Time Evolution and Resonances Eachthemewasreviewedbyanexpertinthe?eld,accompaniedbymorespeci?c, research-like shorter talks. The whole topic of quantum irreversibility in all its manifold aspects has always raised a lot of interest, starting with the description of unstable systems in quantum mechanics and the issue of quantum measurement. Further, in - cent years a boost of activity concerning noise, dissipation and open systems has been prompted by the fast developing ?eld of quantum communication and information theory. These considerations motivated the editors to put together a volume that tries to summarize the present day status of the research in the ?eld, with the aim of providing the reader with an accessible and exhaustive introduction to it.

INTRODUCTORY QUANTUM OPTICS

Cambridge University Press Publisher Description

QUANTUM GRAVITY

FROM THEORY TO EXPERIMENTAL SEARCH

Springer Science & Business Media The relation between quantum theory and the theory of gravitation remains one of the most outstanding unresolved issues of modern physics. According to general expectation, general relativity as well as quantum (field) theory in a fixed background spacetime cannot be fundamentally correct. Hence there should exist a broader theory comprising both in appropriate limits, i.e., quantum gravity. This book gives readers a comprehensive introduction accessible to interested non-experts to the main issues surrounding the search for quantum gravity. These issues relate to fundamental questions concerning the various formalisms of quantization; specific questions concerning concrete processes, like gravitational collapse or black-hole evaporation; and the all important question concerning the possibility of experimental tests of quantum-gravity effects.

TIME IN QUANTUM MECHANICS

Springer The treatment of time in quantum mechanics is still an important and challenging open question in the foundation of the quantum theory. This multi-authored book, written as an introductory guide for newcomers to the subject, as well as a useful source of information for the expert, covers many of the open questions. The book describes the problems, and the attempts and achievements in defining, formalizing and measuring different time quantities in quantum theory.

QUANTUM MECHANICS WITH APPLICATIONS TO NANOTECHNOLOGY AND INFORMATION SCIENCE

Academic Press Quantum mechanics transcends and supplants classical mechanics at the atomic and subatomic levels. It provides the underlying framework for many subfields of physics, chemistry and materials science, including condensed matter physics, atomic physics, molecular physics, quantum chemistry, particle physics, and nuclear physics. It is the only way we can understand the structure of materials, from the semiconductors in our computers to the metal in our automobiles. It is also the scaffolding supporting much of nanoscience and nanotechnology. The purpose of this book is to present the fundamentals of quantum theory within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today. Hence, the emphasis on new topics that are not included in older reference texts, such as quantum information theory, decoherence and dissipation, and on applications to nanotechnology, including quantum dots, wires and wells. This book provides a novel approach to Quantum Mechanics whilst also giving readers the requisite background and training for the scientists and engineers of the 21st Century who need to come to grips with quantum phenomena The fundamentals of quantum theory are provided within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology

Older books on quantum mechanics do not contain the amalgam of ideas, concepts and tools necessary to prepare engineers and scientists to deal with the new facets of quantum mechanics and their application to quantum information science and nanotechnology As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today There are many excellent quantum mechanics books available, but none have the emphasis on nanotechnology and quantum information science that this book has

MINDFUL UNIVERSE

QUANTUM MECHANICS AND THE PARTICIPATING OBSERVER

Springer Science & Business Media The classical mechanistic idea of nature that prevailed in science during the eighteenth and nineteenth centuries was an essentially mindless conception: the physically described aspects of nature were asserted to be completely determined by prior physically described aspects alone, with our conscious experiences entering only passively. During the twentieth century the classical concepts were found to be inadequate. In the new theory, quantum mechanics, our conscious experiences enter into the dynamics in specified ways not fixed by the physically described aspects alone. Consequences of this radical change in our understanding of the connection between mind and brain are described. This second edition contains two new chapters investigating the role of quantum phenomena in the problem of free will and in the placebo effect.

THE EMERGENT MULTIVERSE

QUANTUM THEORY ACCORDING TO THE EVERETT INTERPRETATION

OUP Oxford The Emergent Multiverse presents a striking new account of the 'many worlds' approach to quantum theory. The point of science, it is generally accepted, is to tell us how the world works and what it is like. But quantum theory seems to fail to do this: taken literally as a theory of the world, it seems to make crazy claims: particles are in two places at once; cats are alive and dead at the same time. So physicists and philosophers have often been led either to give up on the idea that quantum theory describes reality, or to modify or augment the theory. The Everett interpretation of quantum mechanics takes the apparent craziness seriously, and asks, 'what would it be like if particles really were in two places at once, if cats really were alive and dead at the same time'? The answer, it turns out, is that if the world were like that—if it were as quantum theory claims—it would be a world that, at the macroscopic level, was constantly branching into copies—hence the more sensationalist name for the Everett interpretation, the 'many worlds theory'. But really, the interpretation is not sensationalist at all: it simply takes quantum theory seriously, literally, as a

description of the world. Once dismissed as absurd, it is now accepted by many physicists as the best way to make coherent sense of quantum theory. David Wallace offers a clear and up-to-date survey of work on the Everett interpretation in physics and in philosophy of science, and at the same time provides a self-contained and thoroughly modern account of it—an account which is accessible to readers who have previously studied quantum theory at undergraduate level, and which will shape the future direction of research by leading experts in the field.