

MATHEMATICAL FOUNDATIONS OF QUANTUM MECHANICS

By John von Neumann

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John Von Neumann And The Foundations Of Quantum Physics

Sahotra Sarkar, Jessica Pfeifer



John Von Neumann And The Foundations Of Quantum Physics:

John von Neumann and the Foundations of Quantum Physics Miklós Rédei, Michael Stöltzner, 2013-03-09 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such as theory of measurement quantum logic and quantum mechanical entropy The volume is rounded off by previously unpublished letters and lectures documenting von Neumann s thinking about quantum theory after his 1932 Mathematical Foundations of Quantum Mechanics The general part of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

John Von Neumann and the Foundations of Quantum Physics Dr Miklos Redei, Michael Stoltzner, 2014-01-15 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

Mathematical Foundations of Quantum Mechanics John von Neumann, 1955 A revolutionary book that for the first time provided a rigorous mathematical framework for quantum mechanics Google books *Mathematical Foundations of Quantum Mechanics* John von Neumann, 2018-02-27 Quantum mechanics was still in its infancy in 1932 when the young John von Neumann who would go on to become one of the greatest mathematicians of the twentieth century published Mathematical Foundations of Quantum Mechanics a revolutionary book that for the first time provided a rigorous mathematical framework for the new science Robert Beyer's 1955 English translation which von Neumann reviewed and approved is cited more frequently today than ever before But its many treasures and insights were too often obscured by the limitations of the way the text and equations were set on the page In this new edition of this classic work mathematical physicist Nicholas Wheeler has completely reset the book in TeX making the text and equations far easier to read He has also corrected a handful of typographic errors revised some sentences for clarity and readability provided an index for the first time and added prefatory remarks drawn from the writings of L on Van Hove and Freeman Dyson The result brings new life to an essential work in theoretical physics and mathematics *Compendium of Quantum Physics* Daniel Greenberger, Klaus Hentschel, Friedel Weinert, 2009-07-25 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 **Foundations of Quantum Mechanics** Roderich Tumulka, 2022-11-22 This book introduces and critically appraises the main proposals for how to understand quantum mechanics namely the Copenhagen interpretation spontaneous collapse Bohmian mechanics many worlds and others The author makes clear what are the crucial problems such as the measurement problem related to the foundations of quantum mechanics and explains the key arguments like the Einstein Podolsky Rosen argument and Bell's proof of nonlocality He discusses and clarifies numerous topics that have puzzled the founding fathers of quantum mechanics and present day students alike such as the possibility of hidden variables the collapse of the wave function time of arrival measurements explanations of the symmetrization postulate for identical particles or the nature of spin Several chapters are devoted to extending the different approaches to relativistic space time and quantum field theory The book is self contained

and is intended for graduate students and researchers who want to step into the fundamental aspects of quantum physics. Given its clarity, it is accessible also to advanced undergraduates and contains many exercises and examples to master the subject.

The Legacy of John Von Neumann James G. Glimm, John Impagliazzo, Isadore Singer, 2006-09-08. The ideas of John von Neumann have had a profound influence on modern mathematics and science. One of the great thinkers of our century, von Neumann initiated major branches of mathematics from operator algebras to game theory to scientific computing and had a fundamental impact on such areas as self-adjoint operators, ergodic theory, and the foundations of quantum mechanics and numerical analysis, and the design of the modern computer. This volume contains the proceedings of an AMS Symposium in Pure Mathematics held at Hofstra University in May 1988. The symposium brought together some of the foremost researchers in the wide range of areas in which von Neumann worked. These articles illustrate the sweep of von Neumann's ideas and thinking and document their influence on contemporary mathematics. In addition, some of those who knew von Neumann when he was alive have presented here personal reminiscences about him. This book is directed to those interested in operator theory, game theory, ergodic theory, and scientific computing, as well as to historians of mathematics and others having an interest in the contemporary history of the mathematical sciences. This book will give readers an appreciation for the workings of the mind of one of the mathematical giants of our time.

Epistemological and Experimental Perspectives on Quantum Physics Daniel Greenberger, W.L. Reiter, Anton Zeilinger, 2013-04-17. From the very beginning, it was realised that quantum physics involves radically new interpretative and epistemological consequences. While hitherto there has been no satisfactory philosophical analysis of these consequences, recent years have witnessed the accomplishment of many experiments to test the foundations of quantum physics, opening up vistas to a completely novel technology, quantum technology. The contributions in the present volume review the interpretative situation, analyze recent fundamental experiments, and discuss the implications of possible future technological applications.

Readership: Analytic philosophers, logical empiricists, scientists, especially physicists, historians of logic, mathematics, and physics, philosophers of science, and advanced students and researchers in these fields. Can be used for seminars on theoretical and experimental physics and philosophy of science, and as supplementary reading at advanced undergraduate and graduate levels.

John S. Bell on the Foundations of Quantum Mechanics J. S. Bell, Mary Bell, Kurt Gottfried, Martinus Veltman, 2001. This book is the most complete collection of John S. Bell's research papers, review articles, and lecture notes on the foundations of quantum mechanics. Some of this material has hitherto been difficult to access. The book also appears in a paperback edition aimed at students and young researchers. This volume will be very useful to researchers in the foundations and applications of quantum mechanics.

The Oxford Handbook of the History of Quantum Interpretations Guido Bacciagaluppi, Olivier Darrigol, Thiago Hartz, Christian Joas, Alexei Kojevnikov, 2022. This Oxford Handbook provides a rigorous interdisciplinary review of the history of interpretations of quantum physics, presenting the key controversies within the field, as well as

outlining its successes and its extraordinary potential across various scientific fields *A Phenomenological Approach to Quantum Mechanics* Steven French, 2024-02-22 Steven French suggests a radical new approach to the understanding of quantum physics derived from Husserl's phenomenological philosophy In this approach consciousness plays a fundamental role that is very different from what has previously been supposed **John von Neumann: Selected Letters** Miklós Rédei, 2022-02-23 John von Neuman was perhaps the most influential mathematician of the twentieth century especially if his broad influence outside mathematics is included Not only did he contribute to almost all branches of mathematics and created new fields but he also changed post World War II history with his work on the design of computers and with being a sought after technical advisor to many figures in the U S military political establishment in the 1940s and 1950s The present volume is the first substantial collection of previously mainly unpublished letters written by von Neumann to colleagues friends government officials and others The letters give us a glimpse of the thinking of John von Neumann about mathematics physics computer science science management education consulting politics and war Readers of quite diverse backgrounds will find much of interest in this fascinating first hand look at one of the towering figures of twentieth century science

The Philosophy of Science Sahotra Sarkar, Jessica Pfeifer, 2006 The first in depth reference to the field that combines scientific knowledge with philosophical inquiry this encyclopedia brings together a team of leading scholars to provide nearly 150 entries on the essential concepts in the philosophy of science The areas covered include biology chemistry epistemology and metaphysics physics psychology and mind the social sciences and key figures in the combined studies of science and philosophy Midwest **Weird Scientists □ the Creators of Quantum Physics** Jeffrey Strickland, 2011-09-04 *Weird Scientists* is a sequel to *Men of Manhattan* As I wrote the latter about the nuclear physicists who brought in the era of nuclear power quantum mechanics or quantum physics was unavoidable Many of the contributors to the science of splitting the atom were also contributors to quantum mechanics Atomic physics particle physics quantum physics and even relativity are all interrelated This book is about the men and women who established the science that shook the foundations of classical physics removed determinism from measurement and created alternative worlds of reality The book introduces fundamental concepts of quantum mechanics roughly in the order they were discovered as a launching point for describing the scientist and the work that brought forth the concepts **Quantum Mechanics** Nouredine Zettili, 2022-09-13 **QUANTUM MECHANICS** An innovative approach to quantum mechanics that seamlessly combines textbook and problem solving book into one *Quantum Mechanics Concepts and Applications* provides an in depth treatment of this fundamental theory combining detailed formalism with straightforward practice Thoroughly integrating close to seven hundred examples solved problems and exercises into a well structured and comprehensive work this textbook offers instructors a pedagogically sound teaching tool students a clear balanced and modern approach to the subject and researchers a quick practical guide The extensive list of fully solved examples and problems have been carefully designed to guide and enable users of the book to

become proficient practitioners of quantum mechanics The text begins with a thorough description of the origins of quantum physics before discussing the mathematical tools required in the field and the postulates upon which it is founded Quantum Mechanics Concepts and Applications is broad in scope covering such aspects as one dimensional and three dimensional potentials angular momentum rotations and addition of angular momenta identical particles time independent and dependent approximation methods scattering theory relativistic quantum mechanics and classical field theory among others Each of these diverse areas are enhanced with a rich collection of illustrative examples and fully solved problems to ensure complete understanding of this complex topic Readers of the third edition of Quantum Mechanics Concepts and Applications will also find Two new chapters one dealing with relativistic quantum mechanics and the other with the Lagrangian derivations of the Klein Gordon and Dirac equations and three new appendices to support them About 90 solved examples integrated throughout the text that are intended to illustrate individual concepts within a broader topic About 200 fully solved multi step problems at the end of each chapter that integrate multiple concepts introduced throughout the chapter More than 400 unsolved exercises that may be used to practice the ideas presented A Solutions Manual is available from the author Prof Nouredine Zettili nzettili@jsu.edu only to those instructors adopting the book on request offering detailed solutions to all exercises Quantum Mechanics Concepts and Applications is a comprehensive textbook which is most useful to senior undergraduate and first year graduate students seeking mastery of the field as well as to researchers in need of a quick practical reference for the various techniques necessary for optimal performance in the subject

The Probability Interpretation and the Statistical Transformation Theory, the Physical Interpretation, and the Empirical and Mathematical Foundations of Quantum Mechanics 1926-1932 Jagdish Mehra, Helmut Rechenberg, 2000-08-25

Quantum Theory together with the principles of special and general relativity constitute a scientific revolution that has profoundly influenced the way in which we think about the universe and the fundamental forces that govern it The Historical Development of Quantum Theory is a definitive historical study of that scientific work and the human struggles that accompanied it from the beginning Drawing upon such materials as the resources of the Archives for the History of Quantum Physics the Niels Bohr Archives and the archives and scientific correspondence of the principal quantum physicists as well as Jagdish Mehra's personal discussions over many years with most of the architects of quantum theory the authors have written a rigorous scientific history of quantum theory in a deeply human context This multivolume work presents a rich account of an intellectual triumph a unique analysis of the creative scientific process The Historical Development of Quantum Theory is science history and biography all wrapped in the story of a great human enterprise Its lessons will be an aid to those working in the sciences and humanities alike

John Von Neumann, 1903-1957 J. C. Oxtoby, B. J. Pettis, G. B. Price, 1966-12-31 This is Bulletin Volume 64 Number 3 Part II May 1958 A memorial to the late John von Neumann edited by J C Oxtoby B J Pettis and E B Price

Landmark Writings in Western Mathematics 1640-1940 Ivor

Grattan-Guinness, 2005-02-11 This book contains around 80 articles on major writings in mathematics published between 1640 and 1940. All aspects of mathematics are covered: pure and applied, probability and statistics, foundations and philosophy. Sometimes two writings from the same period and the same subject are taken together. The biography of the author is recorded and the circumstances of the preparation of the writing are given. When the writing is of some length, an analytical table of its contents is supplied. The contents of the writing are reviewed and its impact described at least for the immediate decades. Each article ends with a bibliography of primary and secondary items. First book of its kind. Covers the period 1640-1940 of massive development in mathematics. Describes many of the main writings of mathematics. Articles written by specialists in their field.

Probing The Meaning Of Quantum Mechanics: Superpositions, Dynamics, Semantics

And Identity Diederik Aerts, Christian De Ronde, Hector Freytes, Roberto Giuntini, 2016-07-21 This book provides an interdisciplinary approach to one of the most fascinating and important open questions in science: What is quantum mechanics really talking about? In the last decades, quantum mechanics has given rise to a new quantum technological era, a revolution taking place today especially within the field of quantum information processing, which goes from quantum teleportation and cryptography to quantum computation. Quantum theory is probably our best confirmed physical theory. However, in spite of its great empirical effectiveness, it stands today still without a universally accepted physical representation that allows us to understand its relation to the world and reality. The novelty of the book comes from the multiple perspectives put forward by top researchers in quantum mechanics from Europe as well as North and South America, discussing the meaning and structure of the theory of quanta. The book comprises, in a balanced manner, physical, philosophical, logical, and mathematical approaches to quantum mechanics and quantum information. Going from quantum superpositions and entanglement to dynamics and the problem of identity, from quantum logic, computation, and quasi-set theory to the category approach and teleportation, from realism and empiricism to operationalism and instrumentalism, the book considers from different angles some of the most intriguing questions in the field. From Buenos Aires to Brussels and Cagliari, from Florence to Florianópolis, the interaction between different groups is reflected in the many different articles. This book is interesting not only to the specialists but also to the general public attempting to get a grasp on some of the most fundamental questions of present quantum physics.

John Stewart Bell and Twentieth-Century Physics Andrew Whitaker, 2016-07-08 John Stewart Bell (1928-1990) was one of the most important figures in twentieth-century physics, famous for his work on the fundamental aspects of the century's most important theory, quantum mechanics. While the debate over quantum theory between the supremely famous physicists Albert Einstein and Niels Bohr appeared to have become sterile in the 1930s, Bell was able to revive it and to make crucial advances. Bell's Theorem or Bell's Inequalities. He was able to demonstrate a contradiction between quantum theory and essential elements of pre-quantum theory: locality and causality. The book gives a non-mathematical account of Bell's relatively impoverished upbringing in Belfast and his education. It

describes his major contributions to quantum theory but also his important work in the physics of accelerators and nuclear and elementary particle physics

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