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DARIO BRYNN

Current Algebra in the Framework of Quantum Field Theory: Lectures Given at the Belgian-dutch Summerschool Springer Nature
The paper begins the general mathematical study of 'current algebras' by elementary particle physicists. They are defined abstractly as infinite dimensional real Lie algebras, whose underlying vector space is a module over the ring of test-functions. Preliminary remarks about classification of these objects and general geometric and algebraic methods of their construction are made. As preparation, certain facts about differential operators on arbitrary modules are presented. In addition, remarks about the differential-geometric nature of the 'energy-momentum tensor' and conformal symmetry are made. Finally, a global transformation group is constructed whose Lie algebra is one of the simplest current algebras.
Foundations of Quantum Theory Math-Sci Press
It has been said that `String theorists talk to string theorists and everyone else wonders what they are saying'. This book will be a great help to those researchers who are challenged by modern quantum field theory. Quantum field theory experienced a renaissance in the late 1960s. Here, participants in the Les Houches sessions of 1970/75, now key players in quantum field theory and its many impacts, assess developments in their field of interest and provide guidance to young researchers challenged by these developments, but overwhelmed by their complexities. The book is not a textbook on string theory, rather it is a complement to Polchinski's book on string theory. It is a survey of current problems which have their origin in quantum field theory.
Topics in the Mathematics of Quantum Mechanics Princeton University Press
Quantum field theory was invented to deal simultaneously with special relativity and quantum mechanics, the two greatest discoveries of early twentieth-century physics, but it has become increasingly important to many areas of physics including quantum hall physics, surface growth, string theory, D-branes and quantum gravity as well as condensed-matter and high-energy applications and particle-physics. This important book presents leading-edge research from throughout the world.
Current Problems in Elementary Particle and Mathematical Physics Nova Publishers
International Series of Monographs in Natural Philosophy, Volume 12: Current Algebras and their Applications provides an introduction to the underlying philosophy and to the technical methods associated with the use of the Current Algebra for the investigation of questions in elementary particle physics. This text contains 10 chapters and begins with the preliminary concepts and basic ideas of current algebras. The next chapters deal with the approximate symmetry and the dispersion theory of current algebras, as well as the current algebra sum rules with PCAC. These topics are followed by reviews of the principles of the low-energy theorems, the Schwinger terms, and the features of the dispersion theory. The last chapter examines the possible connections of current algebras and dynamics. This book will prove useful to mathematicians, physicists, teachers, and students.
From Classical Mechanics To Quantum Field Theory, A Tutorial Springer Science & Business Media
These are the proceedings of the Workshop on Quantum Logic held in Erice (Sicily), December 2 - 9, 1979, at the Ettore Hajorana Centre for Scientific Culture. A conference of this sort was originally proposed by Giuliano Toraldo di Francia, who suggested the idea to Antonino Zichichi, and thus laid the foundation for the Workshop. To both of them we express our appreciation and thanks, also on behalf of the other participants, for having made this conference possible. There were approximately fifty participants; their names and institutions are listed in the text. Quantum logic, which has now a history of some forty or more years, has seen remarkable growth during the sixties and seventies. The papers in the present volume presuppose, by and large, some acquaintance with the elements of the subject. These may be found in the well-known books by J.H. Jauch (Foundations of Quantum Hechanics; Reading, 1968), V.S. Varadarajan (Geometry of Quantum Theory: Princeton, 1968), and C. Piron (Foundations of Quantum Theory; New York, 1976). The initial program for the conference listed about twenty-five invited papers. But in the context of a very active and qualified attendance, other contributions were offered. This volume contains all of them. The program listed six main topics: I. Classification or different areas of quantum logic, and open problems. II. Comparison and unification of different approaches to quantum theories; problems of interpretation. III. Formal quantum logic; axiomatics. IV. Hodal interpretations of quantum logic. v vi FOREWORD V. Quantum set theory.
Current Algebra and Anomalies Springer
This book focuses on a critical discussion of the status and prospects of current approaches in quantum mechanics and quantum field theory, in particular concerning gravity. It contains a carefully selected cross-section of lectures and discussions at the seventh conference “Progress and Visions in Quantum Theory in View of Gravity” which took place in fall 2018 at the Max Planck Institute for Mathematics in the Sciences in Leipzig. In contrast to usual proceeding volumes, instead of reporting on the most recent technical results, contributors were asked to discuss visions and new ideas in foundational physics, in particular concerning foundations of quantum field theory. A special focus has been put on the question of which physical principles of quantum (field) theory can be considered fundamental in view of gravity. The book is mainly addressed to mathematicians and physicists who are interested in fundamental questions of mathematical physics. It allows the reader to obtain a broad and up-to-date overview of a fascinating active research area.
Towards the Mathematics of Quantum Field Theory Scholarly Press
An overview of the conceptual and historical foundations of fundamental field theories, including their underlying issues, logic and dynamics.
Quantum and Fermion Differential Geometry Princeton University Press
Quantum Groups: A Path to Current Algebra presents the latest algebraic concepts and techniques.
The Odd Quantum Springer Science & Business Media
A timely addition to the literature, this volume contains authoritative reviews of three important areas in the physics of elementary particles. Sam B. Treiman, in "Current Algebra and PCAC," reviews the present state of the weak interactions. In "Field Theoretic Investigations in Current Algebra," Roman Jackiw deals with recent developments in current algebra and its applications, giving particular attention to anomalies. David J. Gross covers the high energy inelastic lepton-hadron scattering in his paper, "The High Energy Behavior of Weak and Electromagnetic Interactions." Originally published in 1972. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.
Conceptual Development of 20th Century Field Theories Cambridge University Press
This volume contains papers based on presentations at the “Nagoya Winter Workshop 2015: Reality and Measurement in Algebraic Quantum Theory (NWW 2015)”, held in Nagoya, Japan, in March 2015. The foundations of quantum theory have been a source of mysteries, puzzles, and confusions, and have encouraged innovations in mathematical languages to describe, analyze, and delineate this wonderland. Both ontological and epistemological questions about quantum reality and

measurement have been placed in the center of the mysteries explored originally by Bohr, Heisenberg, Einstein, and Schrödinger. This volume describes how those traditional problems are nowadays explored from the most advanced perspectives. It includes new research results in quantum information theory, quantum measurement theory, information thermodynamics, operator algebraic and category theoretical foundations of quantum theory, and the interplay between experimental and theoretical investigations on the uncertainty principle. This book is suitable for a broad audience of mathematicians, theoretical and experimental physicists, and philosophers of science.

Current Research in Operational Quantum Logic Springer Nature

This book collects independent contributions on current developments in quantum information theory, a very interdisciplinary field at the intersection of physics, computer science and mathematics. Making intense use of the most advanced concepts from each discipline, the authors give in each contribution pedagogical introductions to the main concepts underlying their present research and present a personal perspective on some of the most exciting open problems. Keeping this diverse audience in mind, special efforts have been made to ensure that the basic concepts underlying quantum information are covered in an understandable way for mathematical readers, who can find there new open challenges for their research. At the same time, the volume can also be of use to physicists wishing to learn advanced mathematical tools, especially of differential and algebraic geometric nature.

Current Algebras and Their Applications Birkhäuser

The volume starts with a lecture course by P. Etingof on tensor categories (notes by D. Calaque). This course is an introduction to tensor categories, leading to topics of recent research such as realizability of fusion rings, Ocneanu rigidity, module categories, weak Hopf algebras, Morita theory for tensor categories, lifting theory, categorical dimensions, Frobenius-Perron dimensions, and the classification of tensor categories. The remainder of the book consists of three detailed expositions on associators and the Vassiliev invariants of knots, classical and quantum integrable systems and elliptic algebras, and the groups of algebra automorphisms of quantum groups. The preface puts the results presented in perspective. Directed at research mathematicians and theoretical physicists as well as graduate students, the volume gives an overview of the ongoing research in the domain of quantum groups, an important subject of current mathematical physics.

Reality and Measurement in Algebraic Quantum Theory Springer Science & Business Media

Current algebra remains our most successful analysis of fundamental particle interactions. This collection of surveys on current algebra and anomalies is a successor volume to Lectures on Current Algebra and Its Applications (Princeton Series in Physics, 1972). Originally published in 1986. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Current Algebra and Anomalies Elsevier

Providing an introduction to current research topics in functional analysis and its applications to quantum physics, this book presents three lectures surveying recent progress and open problems. A special focus is given to the role of symmetry in non-commutative probability, in the theory of quantum groups, and in quantum physics. The first lecture presents the close connection between distributional symmetries and independence properties. The second introduces many structures (graphs, C*-algebras, discrete groups) whose quantum symmetries are much richer than their classical symmetry groups, and describes the associated quantum symmetry groups. The last lecture shows how functional analytic and geometric ideas can be used to detect and to quantify entanglement in high dimensions. The book will allow graduate students and young researchers to gain a better understanding of free probability, the theory of compact quantum groups, and applications of the theory of Banach spaces to quantum information. The latter applications will also be of interest to theoretical and mathematical physicists working in quantum theory.

Current Algebra in the Framework of Quantum Field Theory Springer

This is a rare and much-needed book: a concise but comprehensive account of quantum mechanics for popular science readers written by a respected physicist. Sam Treiman--internationally renowned for his work in particle physics--makes quantum mechanics accessible to nonspecialists. Combining mastery of the material with clear, elegant prose and infectious enthusiasm, he conveys the substance, methods, and profound oddities of the field. Treiman begins with an overview of quantum mechanics. He sketches the early development of the field by Einstein, Bohr, Heisenberg, Schrödinger, and others, and he makes clear how the quantum outlook flies in the face of common sense. As he explains, the quantum world is intrinsically probabilistic. For example, a particle is not in general in some particular place at a given instant, nor does it have a definite momentum. According to the Heisenberg uncertainty principle, there is a limit to how well both location and momentum can be specified simultaneously. In addition, particles can move through barriers and otherwise move in regions of space that are forbidden by classical mechanics. If a particle has a choice of different paths, it pursues all of them at once. Particles display wave-like characteristics and waves show particle-like characteristics. Treiman pays special attention to the more fundamental wave outlook and its expression in quantum field theory. He deals here with the remarkable fact that all the particles of a given species are strictly identical, and with the unnerving fact that particles can be created and destroyed. As Treiman introduces us to these and other wonders, he also touches--without resolution--on some of the deep philosophical problems of quantum mechanics, notably how probabilities become facts. Weaving together impeccable and up-to-date science, engaging writing, and a talent for clear explanation honed over Treiman's distinguished career as a physicist and teacher, The Odd Quantum is a remarkable survey of a field that changed the course of modern scientific and philosophical thought.

Quantum Symmetries Springer

This ambitious and original book sets out to introduce to mathematicians (even including graduate students) the mathematical methods of theoretical and experimental quantum field theory, with an emphasis on coordinate-free presentations of the mathematical objects in use. This in turn promotes the interaction between mathematicians and physicists by supplying a common and flexible language for the good of both communities, though mathematicians are the primary target. This reference work provides a coherent and complete mathematical toolbox for classical and quantum field theory, based on categorical and homotopical methods, representing an original contribution to the literature. The first part of the book introduces the mathematical methods needed to work with the physicists' spaces of fields, including parameterized and functional differential geometry, functorial analysis, and the homotopical geometric theory of non-linear partial differential equations, with applications to general gauge theories. The second part presents a large family of examples of classical field theories, both from experimental and theoretical physics, while the third part provides an introduction to quantum field theory, presents various renormalization methods, and discusses the quantization of factorization algebras.

Lectures on Current Algebra and Its Applications Springer Nature

The present volume has its origins in a pair of informal workshops held at the Free University of Brussels, in June of 1998 and May of 1999, named "Current Research 1 in Operational Quantum Logic". These brought together mathematicians and physicists working in operational quantum logic and related areas, as well as a number of interested philosophers of science, for a rare opportunity to discuss recent developments in this field. After some discussion, it was decided that, rather than producing a volume of conference proceedings, we would try to organize the conferees to produce a set of comprehensive survey papers, which would not only report on recent developments in quantum logic, but also provide a tutorial overview of the subject suitable for an interested non-specialist audience. The resulting volume provides an overview of the concepts and methods used in current research in quantum logic, viewed both as a branch of mathemati cal physics and as an area of pure mathematics. The first half of the book is concerned with the algebraic side of the subject, and in particular the theory of orthomodular lattices and posets, effect algebras, etc. In the second half of the book, special attention is given to categorical methods and to connections with theoretical computer science. At the 1999 workshop, we were fortunate to hear three excellent lectures by David J. Foulis, represented here by two contributions. Dave's work, spanning 40 years, has helped to define, and continues to reshape, the field of quantum logic.

Quantum Field Theory: Perspective and Prospective Math Science Press

The advent of quantum chromodynamics (QCD) in the early 1970s was one of the most important events in twentieth-century science. This book examines the conceptual steps that were crucial to the rise of QCD, placing them in historical context against the background of debates that were ongoing between the bootstrap approach and composite modeling, and between mathematical and realistic conceptions of quarks. It explains the origins of QCD in current algebra and its development through high-energy experiments, model-building, mathematical analysis and conceptual synthesis. Addressing a range of complex physical, philosophical and historiographical issues in detail, this book will interest graduate students and researchers in physics and in the history and philosophy of science.

A First Course on Symmetry, Special Relativity and Quantum Mechanics World Scientific

This book provides an in-depth and accessible description of special relativity and quantum mechanics which together form the foundation of 21st century physics. A novel aspect is that symmetry is given its rightful prominence as an integral part of this foundation. The book offers not only a conceptual understanding of symmetry, but also the mathematical tools necessary for quantitative analysis. As such, it provides a valuable precursor to more focused, advanced books on special relativity or quantum mechanics. Students are introduced to several topics not typically covered until much later in their education.These include space-time diagrams, the action principle, a proof of Noether's theorem, Lorentz vectors and tensors, symmetry breaking and general relativity. The book also provides extensive descriptions on topics of current general interest such as gravitational waves, cosmology, Bell's theorem, entanglement and quantum computing. Throughout the text, every opportunity is taken to emphasize the intimate connection between physics, symmetry and mathematics.The style remains light despite the rigorous and intensive content. The book is intended as a stand-alone or supplementary physics text for a one or two semester course for students who have completed an introductory calculus course and a first-year physics course that includes Newtonian mechanics and some electrostatics. Basic knowledge of linear algebra is useful but not essential, as all requisite mathematical background is provided either in the body of the text or in the Appendices. Interspersed through the text are well over a hundred worked examples and unsolved exercises for the student.

SL(2,R) Current Algebra in Two Dimensional Conformal Quantum Gravity Springer

Algebraic Methods in Quantum Chemistry and Physics provides straightforward presentations of selected topics in theoretical chemistry and physics, including Lie algebras and their applications, harmonic oscillators, bilinear oscillators, perturbation theory, numerical solutions of the Schrödinger equation, and parameterizations of the time-evolution operator. The mathematical tools described in this book are presented in a manner that clearly illustrates their application to problems arising in theoretical chemistry and physics. The application techniques are carefully explained with step-by-step instructions that are easy to follow, and the results are organized to facilitate both manual and numerical calculations. Algebraic Methods in Quantum Chemistry and Physics demonstrates how to obtain useful analytical results with elementary algebra and calculus and an understanding of basic quantum chemistry and physics.