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AND ANYON

SUPERCONDUCTIVITY

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Fractional Statistics And Anyon Superconductivity

Frank Wilczek



Fractional Statistics And Anyon Superconductivity:

Fractional Statistics and Anyon Superconductivity Frank Wilczek, 1990 Part I Concepts in fractional statistics part II States of anyon matter part III Reprinted papers **Fractional Statistics and Anyon Superconductivity** Frank Wilczek, 1990 The occurrence of fractional statistics has been discovered in more and more quantum field theory models including some of the most geometrical and canonical ones In a remarkable case the fractional quantum statistics of quasiparticles in the fractional quantized Hall effect FQHE contributes to the understanding of states found there Very recent work has indicated that similar possibilities arise for two dimensional films in certain states of liquid ^3He Perhaps most exciting although quite speculative at this moment are recent attempts to apply fractional statistics to spin systems and specifically to the behaviour of the 2 dimensional copper oxide layers that seem to be critical to the phenomenon of high temperature superconductivity It has recently been shown that fractional statistics automatically implies superconductivity of a qualitatively new kind This collection of reprints with comprehensive commentary will serve as a valuable reference for those interested in the subject but have found it difficult to acquire basic knowledge or a coherent view of the whole due to the scattered literature available at present **Fractional Statistics and Quantum Theory** Avinash Khare, 2005 This book explains the subtleties of quantum statistical mechanics in lower dimensions and their possible ramifications in quantum theory The discussion is at a pedagogical level and is addressed to both graduate students and advanced researchers with a reasonable background in quantum and statistical mechanics Topics in the first part of the book include the flux tube model of anyons the braid group and a detailed discussion about the various aspects of quantum and statistical mechanics of a noninteracting anyon gas The second part of the book includes a detailed discussion about fractional statistics from the point of view of ChernOCosimons theories Topics covered here include ChernOCosimons field theories charged vortices anyon superconductivity and the fractional quantum Hall effect Since the publication of the first edition of the book an exciting possibility has emerged that of quantum computing using anyons A section has therefore been included on this topic in the second edition In addition new sections have been added about scattering of anyons with hard disk repulsion as well as fractional exclusion statistics and negative probabilities **The Hubbard Model And Anyon Superconductivity** Aiyalam P Balachandran, Elisa Ercolessi, A M Srivastava, Giuseppe Morandi, 1990-11-30 Several different models have recently been proposed to explain High Temperature Superconductivity This book gives an authoritative and up to date review of two such proposals namely the Hubbard and Anyon Models This invaluable reference is a must for all physicists interested in the fast paced revolutionary field of High Temperature Superconductivity **Fractional Statistics And Quantum Theory (2nd Edition)** Avinash Khare, 2005-02-02 This book explains the subtleties of quantum statistical mechanics in lower dimensions and their possible ramifications in quantum theory The discussion is at a pedagogical level and is addressed to both graduate students and advanced researchers with a reasonable background in quantum and statistical mechanics Topics in the first

part of the book include the flux tube model of anyons the braid group and a detailed discussion about the various aspects of quantum and statistical mechanics of a noninteracting anyon gas The second part of the book includes a detailed discussion about fractional statistics from the point of view of Chern Simons theories Topics covered here include Chern Simons field theories charged vortices anyon superconductivity and the fractional quantum Hall effect Since the publication of the first edition of the book an exciting possibility has emerged that of quantum computing using anyons A section has therefore been included on this topic in the second edition In addition new sections have been added about scattering of anyons with hard disk repulsion as well as fractional exclusion statistics and negative probabilities

Physics and Mathematics of Anyons

Shiing-Shen Chern, Ching-wu Chu, Chin Sen Ting, 1991 In this volume the fractional quantum Hall effect is reviewed and reexamined with emphasis on the fractional statistics Possible relevance of the anyon idea to high temperature superconductivity is addressed both theoretically and experimentally

Path Integrals in Quantum Mechanics, Statistics,

Polymer Physics, and Financial Markets Hagen Kleinert, 2009 Topological restrictions These are relevant to the understanding of the statistical properties of elementary particles and the entanglement phenomena in polymer physics and biophysics The Chern Simons theory of particles with fractional statistics anyons is introduced and applied to explain the fractional quantum Hall effect The relevance of path integrals to financial markets is discussed and improvements of the famous Black Scholes formula for option prices are developed which account for the fact that large market fluctuations occur much more frequently than in Gaussian distributions Book Jacket

Physics and Mathematics of Anyons Shiing-Shen

Chern, 1991-01-01 **Entropy and Non-Equilibrium Statistical Mechanics** Antonio M. Scarfone, Sumiyoshi Abe, Róbert Kovács, 2020-12-15 Nonequilibrium statistical mechanics has a long history featuring diverse aspects It has been a major research field in physics and will remain so in the future Even regarding the concept of entropy there exists a longstanding problem concerning its definition for a system in a state far from equilibrium In this Special Issue we offered the possibility to discuss and present up to date problems that were not necessarily restricted to statistical mechanics Theoretical and experimental papers are both presented in addition to unifying research works As the entropy itself is the central element of nonequilibrium processes papers discuss various formulations of the second law and its consequences In this Special Issue recent progress in kinetic approaches to hydrodynamics rational extended thermodynamics entropy in a strongly nonequilibrium stationary state and related topics are reported as both review articles as well as original research works

High Energy Physics Index, 1994 **Twenty Years Of Bialowieza: A Mathematical Anthology: Aspects Of**

Differential Geometric Methods In Physics S Twareque Ali, Gerard Gustav Emch, Anatol Odziejewicz, Martin

Schlichenmaier, Stanislaw L Woronowicz, 2005-01-27 This volume marks the twentieth anniversary of the Bialowieza series of meetings on Differential Geometric Methods in Physics the anniversary meeting was held during July 1-7 2001 The Bialowieza meetings held every year during the first week of July have now grown into an annual pilgrimage for an

international group of physicists and mathematicians The topics discussed at the meetings while within the broad area of differential geometric methods in physics have focused around quantization coherent states infinite dimensional systems symplectic geometry spectral theory and harmonic analysis The present volume brings together a set of specially invited papers from leading experts in the various fields who have contributed to these meetings and whose work represents a cross section of the topics discussed Consequently rather than a proceedings volume this book embodies the spirit of the Bialowieza workshops and reflects their scientific tenor as a tribute to the completion of two decades of a shared scientific experience This book will be of interest to researchers and graduate students working in the area of differential geometric methods in physics as it gives interesting glimpses into the present state of the art from different points of view

Introduction to Topological Quantum Matter & Quantum Computation Tudor D. Stanescu, 2024-07-02 What is topological about topological quantum states How many types of topological quantum phases are there What is a zero energy Majorana mode how can it be realized in a solid state system and how can it be used as a platform for topological quantum computation What is quantum computation and what makes it different from classical computation Addressing these and other related questions Introduction to Topological Quantum Matter gapless topological phases including Weyl semimetals periodically driven topological insulators and a discussion of axion electrodynamics in topological materials Key Features Provides an accessible introduction to this exciting cross disciplinary area of research Fully updated throughout with new content on the latest result from the field Authored by an authority on the subject Tudor Stanescu is a professor of Condensed Matter Theory at West Virginia University USA He received a B S in Physics from the University of Bucharest Romania in 1994 and a Ph D in Theoretical Physics from the University of Illinois at Urbana Champaign in 2002 He was a Postdoctoral Fellow at Rutgers University and at the University of Maryland from 2003 to 2009 He joined the Department of Physics and Astronomy at West Virginia University in Fall 2009 Prof Stanescu s research interests encompass a variety of topics in theoretical condensed matter physics including topological insulators and superconductors topological quantum computation ultra cold atom systems in optical lattices and strongly correlated materials such as for example cuprate high temperature superconductors His research uses a combination of analytical and numerical tools and focuses on understanding the emergence of exotic states of matter in solid state and cold atom structures for example topological superconducting phases that host Majorana zero modes and on investigating the possibilities of exploiting these states as physical platforms for quantum computation

Solid State Physics John J. Quinn, Kyung-Soo Yi, 2018-02-23 This book provides the basis for a two semester graduate course on solid state physics The first half presents all the knowledge necessary for a one semester survey of solid state physics but in greater depth than most introductory solid state physics courses The second half includes most of the important research over the past half century covering both the fundamental principles and most recent advances This new edition includes the latest developments in the treatment of strongly

interacting two dimensional electrons and discusses the generalization from small to larger systems The book provides explanations in a class tested tutorial style and each chapter includes problems reviewing key concepts and calculations The updated exercises and solutions enable students to become familiar with contemporary research activities such as the electronic properties of massless fermions in graphene and topological insulators The Electron Liquid Paradigm in Condensed Matter Physics Gabriele Giuliani, Giovanni Vignale, Società italiana di fisica, 2004 The electron liquid paradigm is at the basis of most of our current understanding of the physical properties of electronic systems Quite remarkably the latter are nowadays at the intersection of the most exciting areas of science materials science quantum chemistry nano electronics biology and quantum computation Accordingly its importance can hardly be overestimated During the past 20 years the field has witnessed momentous developments which are partly covered in this new volume ultra pure electron nature can be tuned by electrical means allowing a systematic exploration of both strongly and weakly correlated regimes Most of these system are two or even one dimensional and can be coupled together in the form of multi layers or multi wires opening vast observational possibilities On the theoretical side quantum Monte Carlo methods have allowed an essentially exact determination of the ground state energy of the electron liquid and have provided partial answers to the still open question of the structure of its phase diagram Starting from the 1980s some truly revolutionary concepts have emerged which are well represented in this volume **Quantum Hall Effect** Michael Stone, 1992 This book is a compilation of major reprint articles on one of the most intriguing phenomena in modern physics the quantum Hall effect Together with a detailed introduction by the editor this volume serves as a stimulating and valuable reference for students and research workers in condensed matter physics and for those with a particle physics background The papers have been chosen with the intention of emphasizing the topological aspects of the quantum Hall effect and its connections with other branches of theoretical physics such as topological quantum field theories and string theory The contents include sections on integer effect fractional effect effect of global topology effective theories edge states and non Abelian statistics Classical Topology and Quantum States A. P. Balachandran, 1991 This book is an introduction to the role of topology in the quantization of classical systems It is also an introduction to topological solitons with special emphasis on Skyrmions As regards the first aspect several issues of current interest are dealt with at a reasonably elementary level Examples are principal fibre bundles and their role in quantum physics the possibility of spinorial quantum states in a Lagrangian theory based on tensorial variables and multiply connected configuration spaces and associated quantum phenomena like the QCD θ angle and exotic statistics The ideas are also illustrated by simple examples such as the spinning particle the charge monopole system and strings in 3+1 dimensions The application of these ideas to quantum gravity is another subject treated at an introductory level An attempt has been made in this book to introduce the reader to the significance of topology for many distinct physical systems such as spinning particles the charge monopole system strings Skyrmions QCD and gravity The book is an outgrowth of lectures given by the authors at

various institutions and conferences Statistics of Knots and Entangled Random Walks Sergei K. Nechaev, 1996 In this book the author announces the class of problems called entropy of knots and gives an overview of modern physical applications of existing topological invariants He constructs statistical models on knot diagrams and braids using the representations of Jones Kauffman and Alexander invariants and puts forward the question of limit distribution of these invariants for randomly generated knots The relation of powers of corresponding algebraic invariants to the Lyapunov exponents of the products of noncommutative matrices is described Also the problem of conditional joint limit distributions for brownian bridges on braids is discussed Special cases of noncommutative groups $PSL(2, \mathbb{R})$ $PSL(2, \mathbb{Z})$ and braid groups are considered in detail In this volume the author also discusses the application of conformal methods for explicit construction of topological invariants for random walks on multiconnected manifolds The construction of these topological invariants and the monodromy properties of correlation function of some conformal theories are also discussed The author also considers the physical applications of knot entropy problem in various physical systems focussing on polymer *Aspects topologiques de la physique en basse dimension. Topological aspects of low dimensional systems* A. Comtet, T. Jolicoeur, S. Ouvry, F. David, 2003-07-01 Session LXIX 7 31 July 1998 Path Integrals In Quantum Mechanics, Statistics, Polymer Physics, And Financial Markets (4th Edition) Hagen Kleinert, 2006-07-19 This is the fourth expanded edition of the comprehensive textbook published in 1990 on the theory and applications of path integrals It is the first book to explicitly solve path integrals of a wide variety of nontrivial quantum mechanical systems in particular the hydrogen atom The solutions have become possible by two major advances The first is a new euclidean path integral formula which increases the restricted range of applicability of Feynman's famous formula to include singular attractive $1/r$ and $1/r^2$ potentials The second is a simple quantum equivalence principle governing the transformation of euclidean path integrals to spaces with curvature and torsion which leads to time sliced path integrals that are manifestly invariant under coordinate transformations In addition to the time sliced definition the author gives a perturbative definition of path integrals which makes them invariant under coordinate transformations A consistent implementation of this property leads to an extension of the theory of generalized functions by defining uniquely integrals over products of distributions The powerful Feynman Kleinert variational approach is explained and developed systematically into a variational perturbation theory which in contrast to ordinary perturbation theory produces convergent expansions The convergence is uniform from weak to strong couplings opening a way to precise approximate evaluations of analytically unsolvable path integrals Tunneling processes are treated in detail The results are used to determine the lifetime of supercurrents the stability of metastable thermodynamic phases and the large order behavior of perturbation expansions A new variational treatment extends the range of validity of previous tunneling theories from large to small barriers A corresponding extension of large order perturbation theory also applies now to small orders Special attention is devoted to path integrals with topological restrictions These are relevant to the understanding of the

statistical properties of elementary particles and the entanglement phenomena in polymer physics and biophysics The Chern Simons theory of particles with fractional statistics anyons is introduced and applied to explain the fractional quantum Hall effect The relevance of path integrals to financial markets is discussed and improvements of the famous Black Scholes formula for option prices are given which account for the fact that large market fluctuations occur much more frequently than in the commonly used Gaussian distributions The author's other book on Critical Properties of 4 Theories gives a thorough introduction to the field of critical phenomena and develops new powerful resummation techniques for the extraction of physical results from the divergent perturbation expansions

Quantum Coherence And Reality: In Celebration Of The 60th Birthday Of Yakir Aharonov - Proceedings Of The International Conference On Fundamental Aspects Of Quantum Theory Jeeva Anandan, John Safko, 1995-02-23 This volume constitutes the proceedings of the above conference held to celebrate the 60th birthday of Yakir Aharonov Two Nobel laureates Norman Ramsey and Charles Townes members of the National Academy of Sciences and Cresson Medal winners were among the speakers Among the topics discussed are quantum reality geometric phases and the Aharonov Bohm effect spin and statistics black holes and quantum gravity All of these are fundamental to our understanding of quantum theory and are related by being aspects of quantum theory on subjects that Yakir Aharonov has considered

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