

## Quantum Field Theory A Modern Introduction

Presenting a variety of topics that are only briefly touched on in other texts, this book provides a thorough introduction to the techniques of field theory. Covering Feynman diagrams and path integrals, the author emphasizes the path integral approach, the Wilsonian approach to renormalization, and the physics of non-abelian gauge theory. It provides a thorough treatment of quark confinement and chiral symmetry breaking, topics not usually covered in other texts at this level. The Standard Model of particle physics is discussed in detail. Connections with condensed matter physics are explored, and there is a brief, but detailed, treatment of non-perturbative semi-classical methods. Ideal for graduate students in high energy physics and condensed matter physics, the book contains many problems, which help students practise the key techniques of quantum field theory.

Modern introduction to quantum field theory for graduates, providing intuitive, physical explanations supported by real-world applications and homework problems.

The importance and the beauty of modern quantum field theory resides in the power and variety of its methods and ideas, which find application in domains as different as particle physics, cosmology, condensed matter, statistical mechanics and critical phenomena. This book introduces the reader to the modern developments in a manner which assumes no previous knowledge of quantum field theory. Along with standard topics like Feynman diagrams, the book discusses effective lagrangians, renormalization group equations, the path integral formulation, spontaneous symmetry breaking and non-abelian gauge theories. The inclusion of more advanced topics will also make this a most useful book for graduate students and researchers.

A pedagogical account of quantum field theory incorporating modern methods.

Since the advent of Yang–Mills theories and supersymmetry in the 1970s, quantum field theory - the basis of the modern description of physical phenomena at the fundamental level - has undergone revolutionary developments. This is the first systematic and comprehensive text devoted specifically to modern field theory, bringing readers to the cutting edge of current research. The book emphasizes nonperturbative phenomena and supersymmetry. It includes a thorough discussion of various phases of gauge theories, extended objects and their quantization, and global supersymmetry from a modern perspective. Featuring extensive cross-referencing from traditional topics to recent breakthroughs in the field, it prepares students for independent research. The side boxes summarizing the main results and over 70 exercises make this an indispensable book for graduate students and researchers in theoretical physics.

This text presents an intuitive and robust mathematical image of fundamental particle physics based on a novel approach to quantum field theory, which is guided by four carefully motivated metaphysical postulates. In particular, the book explores a dissipative approach to quantum field theory, which is illustrated for scalar field theory and quantum electrodynamics, and proposes an attractive explanation of the Planck scale in quantum gravity. Offering a radically new perspective on this topic, the book focuses on the conceptual foundations of quantum field theory and ontological questions. It also suggests a new stochastic simulation technique in quantum field theory which is complementary to existing ones. Encouraging rigor in a field containing many mathematical subtleties and pitfalls this text is a helpful companion for students of physics and philosophers interested in quantum field theory, and it allows readers to gain an intuitive rather than a formal understanding.

Since it was first published, Quantum Field Theory in a Nutshell has quickly established itself as the most accessible and comprehensive introduction to this profound and deeply fascinating area of theoretical physics. Now in this fully revised and expanded edition, A. Zee covers the latest advances while providing a solid conceptual foundation for students to build on, making this the most up-to-date and modern textbook on quantum field theory available. This expanded edition features several additional chapters, as well as an entirely new section describing recent developments in quantum field theory such as gravitational waves, the helicity spinor formalism, on-shell gluon scattering, recursion relations for amplitudes with complex momenta, and the hidden connection between Yang-Mills theory and Einstein gravity. Zee also provides added exercises, explanations, and examples, as well as detailed appendices, solutions to selected exercises, and suggestions for further reading. The most accessible and comprehensive introductory textbook available Features a fully revised, updated, and expanded text Covers the latest exciting advances in the field Includes new exercises Offers a one-of-a-kind resource for students and researchers Leading universities that have adopted this book include: Arizona State University Boston University Brandeis University Brown University California Institute of Technology Carnegie Mellon College of William & Mary Cornell Harvard University Massachusetts Institute of Technology Northwestern University Ohio State University Princeton University Purdue University - Main Campus Rensselaer Polytechnic Institute Rutgers University - New Brunswick Stanford University University of California - Berkeley University of Central Florida University of Chicago University of Michigan University of Montreal University of Notre Dame Vanderbilt University Virginia Tech University

This primer is a comprehensive collection of analytical and numerical techniques that can be used to extract the non-perturbative physics of quantum field theories. The intriguing connection between Euclidean Quantum Field Theories (QFTs) and statistical mechanics can be used to apply Markov Chain Monte Carlo (MCMC) methods to investigate strongly coupled QFTs. The overwhelming amount of reliable results coming from the field of lattice quantum chromodynamics stands out as an excellent example of MCMC methods in QFTs in action. MCMC methods have revealed the non-perturbative phase structures, symmetry breaking, and bound states of particles in QFTs. The applications also resulted in new outcomes due to cross-fertilization with research areas such as AdS/CFT correspondence in string theory and condensed matter physics. The book is aimed at advanced undergraduate students and graduate students in physics and applied mathematics, and researchers in MCMC simulations and QFTs. At the end

of this book the reader will be able to apply the techniques learned to produce more independent and novel research in the field.

Quantum field theory provides the theoretical backbone to most modern physics. It explains the standard model of particle physics and the existence of the Higgs boson, the physics of states of matter such as metals, magnets and superconductors, and allows us to understand the behaviour of polymers and biological molecules. However, quantum field theory has a reputation for difficulty, reinforced by a selection of weighty and inaccessible books on the subject aimed firmly at those who will make future advances in the subject. The authors of this book believe the subject is too important to be restricted to the professionals and have designed this book to bring quantum field theory to a wider audience of physicists. The book is packed with worked examples, witty diagrams, and applications intended to introduce a new audience to this revolutionary theory.

Quantum Field Theory provides a theoretical framework for understanding fields and the particles associated with them, and is the basis of particle physics and condensed matter research. This graduate level textbook provides a comprehensive introduction to quantum field theory, giving equal emphasis to operator and path integral formalisms. It covers modern research such as helicity spinors, BCFW construction and generalized unitarity cuts; as well as treating advanced topics including BRST quantization, loop equations, and finite temperature field theory. Various quantum fields are described, including scalar and fermionic fields, Abelian vector fields and Quantum ElectroDynamics (QED), and finally non-Abelian vector fields and Quantum ChromoDynamics (QCD). Applications to scattering cross sections in QED and QCD are also described. Each chapter ends with exercises and an important concepts section, allowing students to identify the key aspects of the chapter and test their understanding.

Quantum field theory, which started with Paul Dirac's work shortly after the discovery of quantum mechanics, has produced an impressive and important array of results. Quantum electrodynamics, with its extremely accurate and well-tested predictions, and the standard model of electroweak and chromodynamic (nuclear) forces are examples of successful theories. Field theory has also been applied to a variety of phenomena in condensed matter physics, including superconductivity, superfluidity and the quantum Hall effect. The concept of the renormalization group has given us a new perspective on field theory in general and on critical phenomena in particular. At this stage, a strong case can be made that quantum field theory is the mathematical and intellectual framework for describing and understanding all physical phenomena, except possibly for a quantum theory of gravity. Quantum Field Theory: A Modern Perspective presents Professor Nair's view of certain topics in field theory loosely knit together as it grew out of courses on field theory and particle physics taught at Columbia University and the City College of CUNY. The first few chapters, up to Chapter 12, contain material that generally goes into any course on quantum field theory, although there are a few nuances of presentation which readers may find to be different from other books. This first part of the book can be used for a general course on field theory, omitting, perhaps, the last three sections in Chapter 3, the last two in Chapter 8 and sections 6 and 7 in Chapter 10. The remaining chapters cover some of the more modern developments over the last three decades, involving topological and geometrical features. The introduction given to the mathematical basis of this part of the discussion is necessarily brief and should be accompanied by books on the relevant mathematical topics as indicated in the bibliography. Professor Nair also concentrates on developments pertinent to a better understanding of the standard model. There is no discussion of supersymmetry, supergravity, developments in field theory inspired by string theory, etc. There is also no detailed discussion of the renormalization group. Each of these topics would require a book in its own right to do justice to the topic. Quantum Field Theory: A Modern Perspective serves as a portal to so many more topics of detailed and ongoing research, referring readers to more detailed treatments for many specific topics. The book also contains extensive references, providing readers a more comprehensive perspective on the literature and the historical development of the subject. V. Parameswaran Nair is Professor of Physics at City College of The City University of New York (CUNY). Professor Nair has held Visiting Professorships at The Abdus Salam International Center for Theoretical Physics, Rockefeller University, Institute for Advanced Study at Princeton, and Massachusetts Institute of Technology.

A fully updated edition of the classic text by acclaimed physicist A. Zee. Since it was first published, Quantum Field Theory in a Nutshell has quickly established itself as the most accessible and comprehensive introduction to this profound and deeply fascinating area of theoretical physics. Now in this fully revised and expanded edition, A. Zee covers the latest advances while providing a solid conceptual foundation for students to build on, making this the most up-to-date and modern textbook on quantum field theory available. This expanded edition features several additional chapters, as well as an entirely new section describing recent developments in quantum field theory such as gravitational waves, the helicity spinor formalism, on-shell gluon scattering, recursion relations for amplitudes with complex momenta, and the hidden connection between Yang-Mills theory and Einstein gravity. Zee also provides added exercises, explanations, and examples, as well as detailed appendices, solutions to selected exercises, and suggestions for further reading. The most accessible and comprehensive introductory textbook available. Features a fully revised, updated, and expanded text. Covers the latest exciting advances in the field. Includes new exercises. Offers a one-of-a-kind resource for students and researchers. Leading universities that have adopted this book include: Arizona State University, Boston University, Brandeis University, Brown University, California Institute of Technology, Carnegie Mellon, College of William & Mary, Cornell, Harvard University, Massachusetts Institute of Technology, Northwestern University, Ohio State University, Princeton University, Purdue University - Main Campus, Rensselaer Polytechnic Institute, Rutgers University - New Brunswick, Stanford University, University of California - Berkeley, University of Central Florida, University of Chicago, University of Michigan, University of Montreal, University of Notre Dame, Vanderbilt University, Virginia Tech, University of Wisconsin. Quantum Field Theory has become the universal language of most modern theoretical physics. This introductory

textbook shows how this beautiful theory offers the correct mathematical framework to describe and understand the fundamental interactions of elementary particles. The book begins with a brief reminder of basic classical field theories, electrodynamics and general relativity, as well as their symmetry properties, and proceeds with the principles of quantisation following Feynman's path integral approach. Special care is used at every step to illustrate the correct mathematical formulation of the underlying assumptions. Gauge theories and the problems encountered in their quantisation are discussed in detail. The last chapters contain a full description of the Standard Model of particle physics and the attempts to go beyond it, such as grand unified theories and supersymmetry. Written for advanced undergraduate and beginning graduate students in physics and mathematics, the book could also serve as a reference for active researchers in the field.

Quantum field theory provides the theoretical backbone to most modern physics. This book is designed to bring quantum field theory to a wider audience of physicists. It is packed with worked examples, witty diagrams, and applications intended to introduce a new audience to this revolutionary theory.

An Introduction to Quantum Field Theory is a textbook intended for the graduate physics course covering relativistic quantum mechanics, quantum electrodynamics, and Feynman diagrams. The authors make these subjects accessible through carefully worked examples illustrating the technical aspects of the subject, and intuitive explanations of what is going on behind the mathematics. After presenting the basics of quantum electrodynamics, the authors discuss the theory of renormalization and its relation to statistical mechanics, and introduce the renormalization group. This discussion sets the stage for a discussion of the physical principles that underlie the fundamental interactions of elementary particle physics and their description by gauge field theories.

Providing a broad review of many techniques and their application to condensed matter systems, this book begins with a review of thermodynamics and statistical mechanics, before moving onto real and imaginary time path integrals and the link between Euclidean quantum mechanics and statistical mechanics. A detailed study of the Ising, gauge-Ising and XY models is included. The renormalization group is developed and applied to critical phenomena, Fermi liquid theory and the renormalization of field theories. Next, the book explores bosonization and its applications to one-dimensional fermionic systems and the correlation functions of homogeneous and random-bond Ising models. It concludes with Bohm–Pines and Chern–Simons theories applied to the quantum Hall effect. Introducing the reader to a variety of techniques, it opens up vast areas of condensed matter theory for both graduate students and researchers in theoretical, statistical and condensed matter physics.

This book is a modern introduction to the ideas and techniques of quantum field theory. After a brief overview of particle physics and a survey of relativistic wave equations and Lagrangian methods, the author develops the quantum theory of scalar and spinor fields, and then of gauge fields. The emphasis throughout is on functional methods, which have played a large part in modern field theory. The book concludes with a brief survey of "topological" objects in field theory and, new to this edition, a chapter devoted to supersymmetry. Graduate students in particle physics and high energy physics will benefit from this book.

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.

Comprehensive introduction to quantum field theory by Nobel Laureate Steven Weinberg, now available in paperback.

Quantum Field Theory A Modern Perspective Springer Science & Business Media

A Modern Course in Quantum Field Theory provides a self-contained pedagogical and constructive presentation of quantum field theory. Written for advanced students, the work provides complete material for a two or three semester course and includes numerous problem exercises, some with detailed solutions.

Unique in its coverage of all aspects of modern particle physics, this textbook provides a clear connection between the theory and recent experimental results, including the discovery of the Higgs boson at CERN. It provides a comprehensive and self-contained description of the Standard Model of particle physics suitable for upper-level undergraduate students and graduate students studying experimental particle physics. Physical theory is introduced in a straightforward manner with full mathematical derivations throughout. Fully-worked examples enable students to link the mathematical theory to results from modern particle physics experiments. End-of-chapter exercises, graded by difficulty, provide students with a deeper understanding of the subject. Online resources available at [www.cambridge.org/MPP](http://www.cambridge.org/MPP) feature password-protected fully-worked solutions to problems for instructors, numerical solutions and hints to the problems for students and PowerPoint slides and JPEGs of figures from the book.

This is the first volume of a modern introduction to quantum field theory which addresses both mathematicians and physicists, at levels ranging from advanced undergraduate students to professional scientists. The book bridges the acknowledged gap between the different languages used by mathematicians and physicists. For students of mathematics the author shows that detailed knowledge of the physical background helps to motivate the mathematical subjects and to discover interesting interrelationships between quite different mathematical topics. For students of physics, fairly advanced mathematics is presented, which goes beyond the usual curriculum in physics.

The book provides a step by step construction of the framework of relativistic quantum field theory, starting from a minimal set of basic foundational postulates. The emphasis is on a careful and detailed description of the conceptual subtleties of modern field theory, many of which are glossed over in other texts.

Quantum field theory is the basic mathematical framework that is used to describe elementary particles. This textbook provides a complete and essential introduction to the subject. Assuming only an undergraduate knowledge of quantum mechanics and special relativity, this book is ideal for graduate students beginning the study of elementary particles. The step-by-step presentation begins with basic concepts illustrated by simple examples, and proceeds through historically

important results to thorough treatments of modern topics such as the renormalization group, spinor-helicity methods for quark and gluon scattering, magnetic monopoles, instantons, supersymmetry, and the unification of forces. The book is written in a modular format, with each chapter as self-contained as possible, and with the necessary prerequisite material clearly identified. It is based on a year-long course given by the author and contains extensive problems, with password protected solutions available to lecturers at [www.cambridge.org/9780521864497](http://www.cambridge.org/9780521864497).

This is the first volume of a modern introduction to quantum field theory which addresses both mathematicians and physicists ranging from advanced undergraduate students to professional scientists. The book tries to bridge the existing gap between the different languages used by mathematicians and physicists. For students of mathematics it is shown that detailed knowledge of the physical background helps to motivate the mathematical subjects and to discover interesting interrelationships between quite different mathematical topics. For students of physics, fairly advanced mathematics is presented, which is beyond the usual curriculum in physics. It is the author's goal to present the state of the art of realizing Einstein's dream of a unified theory for the four fundamental forces in the universe (gravitational, electromagnetic, strong, and weak interaction). From the reviews: "Quantum field theory is one of the great intellectual edifices in the history of human thought. This volume differs from other books on quantum field theory in its greater emphasis on the interaction of physics with mathematics. an impressive work of scholarship." (William G. Faris, SIAM Review, Vol. 50 (2), 2008) "it is a fun book for practicing quantum field theorists to browse, and it may be similarly enjoyed by mathematical colleagues. Its ultimate value may lie in encouraging students to enter this challenging interdisciplinary area of mathematics and physics. Summing Up: Recommended. Upper-division undergraduates through faculty." (M. C. Ogilvie, CHOICE, Vol. 44 (9), May, 2007)"

A balanced combination of introductory and advanced topics provides a new and unique perspective on the quantum field theory approach to condensed matter physics. Beginning with the basics of these subjects, such as static and vibrating lattices, independent and interacting electrons, the functional formulation for fields and different generating functionals and their roles, this book presents a unified viewpoint illustrating the connections and relationships among various physical concepts and mechanisms. Advanced and newer topics bring the book up to date with current developments and include sections on cuprate and pnictide superconductors, graphene, Weyl semimetals, transition metal dichalcogenides and topological insulators. Finally, well-known subjects such as the quantum Hall effect, superconductivity, Mott and Anderson insulators, and the Anderson–Higgs mechanism are examined within a unifying QFT-CMP approach. Presenting new insights on traditional topics, this text allows graduate students and researchers to master the proper theoretical tools required in a variety of condensed matter physics systems.

In a relatively simple presentation that remains close to familiar concepts, this text for upper-level undergraduates and graduate students introduces modern developments of quantum field theory. "Combines thorough knowledge with a high degree of didactic ability and a delightful style." — Mathematical Reviews. 1961 edition.

This book takes a pedagogical approach to explaining quantum gravity, supersymmetry and string theory in a coherent way. It is aimed at graduate students and researchers in quantum field theory and high-energy physics. The first part of the book introduces quantum gravity, without requiring previous knowledge of general relativity (GR). The necessary geometrical aspects are derived afresh leading to explicit general Lagrangians for gravity, including that of general relativity. The quantum aspect of gravitation, as described by the graviton, is introduced and perturbative quantum GR is discussed. The Schwinger-DeWitt formalism is developed to compute the one-loop contribution to the theory and renormalizability aspects of the perturbative theory are also discussed. This follows by introducing only the very basics of a non-perturbative, background-independent, formulation of quantum gravity, referred to as "loop quantum gravity", which gives rise to a quantization of space. In the second part the author introduces supersymmetry and its consequences. The generation of superfields is represented in detail. Supersymmetric generalizations of Maxwell's Theory as well as of Yang-Mills field theory, and of the standard model are worked out. Spontaneous symmetry breaking, improvement of the divergence problem in supersymmetric field theory, and its role in the hierarchy problem are covered. The unification of the fundamental constants in a supersymmetric version of the standard model are then studied. Geometrical aspects necessary to study supergravity are developed culminating in the derivation of its full action. The third part introduces string theory and the analysis of the spectra of the mass (squared) operator associated with the oscillating strings. The properties of the underlying fields, associated with massless particles, encountered in string theory are studied in some detail. Elements of compactification, duality and D-branes are given, as well of the generation of vertices and interactions of strings. In the final sections, the author shows how to recover GR and the Yang-Mills field Theory from string theory.

Provides a comprehensive discussion of the gauge revolution and the theoretical and experimental evidence which makes the Standard Model the leading theory of subatomic phenomena.

Presents recent advances of perturbative relativistic field theory in a pedagogical and straightforward way. For graduate students who intend to specialize in high-energy physics.

Following on from the successful first (1984) and revised (1993) editions, this extended and revised text is designed as a short and simple introduction to quantum field theory for final year physics students and for postgraduate students beginning research in theoretical and experimental particle physics. The three main objectives of the book are to: Explain the basic physics and formalism of quantum field theory To make the reader proficient in theory calculations using Feynman diagrams To introduce the reader to gauge theories, which play a central role in elementary particle physics. Thus, the first ten chapters deal with QED in the canonical formalism, and are little changed from the first edition. A brief introduction to gauge theories (Chapter 11) is then followed by two sections, which may be read independently of each other. They cover QCD and related topics (Chapters 12-15) and the unified electroweak theory (Chapters 16 - 19)

respectively. Problems are provided at the end of each chapter. New to this edition: Five new chapters, giving an introduction to quantum chromodynamics and the methods used to understand it: in particular, path integrals and the renormalization group. The treatment of electroweak interactions has been revised and updated to take account of more recent experiments.

Devoted specifically to modern field theory, this is an indispensable book for graduate students and researchers in theoretical physics. It emphasizes nonperturbative phenomena and supersymmetry, and discusses various phases of gauge theories, extended objects and their quantization, and global supersymmetry from a modern perspective. This is the first introductory textbook on quantum field theory to be written from the point of view of condensed matter physics. As such, it presents the basic concepts and techniques of statistical field theory, clearly explaining how and why they are integrated into modern (and classical) field theory, and includes the latest developments. Written by an expert in the field, with a broad experience in teaching and training, it manages to present such substantial topics as phases and phase transitions or solitons and instantons in an accessible and concise way. Divided into two parts, the first covers fundamental physics and the mathematics background needed by students in order to enter the field, while the second part discusses applications of quantum field theory to a few basic problems. The emphasis here lies on how modern concepts of quantum field theory are embedded in these approaches, and also on the limitations of standard quantum field theory techniques in facing 'real' physics problems. Throughout, there are numerous end-of-chapter problems, and a free solutions manual is available for lecturers.

This book comprises the lectures of a two-semester course on quantum field theory, presented in a quite informal and personal manner. The course starts with relativistic one-particle systems, and develops the basics of quantum field theory with an analysis on the representations of the Poincaré group. Canonical quantization is carried out for scalar, fermion, Abelian and non-Abelian gauge theories. Covariant quantization of gauge theories is also carried out with a detailed description of the BRST symmetry. The Higgs phenomenon and the standard model of electroweak interactions are also developed systematically. Regularization and (BPHZ) renormalization of field theories as well as gauge theories are discussed in detail, leading to a derivation of the renormalization group equation. In addition, two chapters — one on the Dirac quantization of constrained systems and another on discrete symmetries — are included for completeness, although these are not covered in the two-semester course. This second edition includes two new chapters, one on Nielsen identities and the other on basics of global supersymmetry. It also includes two appendices, one on fermions in arbitrary dimensions and the other on gauge invariant potentials and the Fock-Schwinger gauge.

This book is a course in modern quantum field theory as seen through the eyes of a theorist working in condensed matter physics. It contains a gentle introduction to the subject and therefore can be used even by graduate students. The introductory parts include a derivation of the path integral representation, Feynman diagrams and elements of the theory of metals including a discussion of Landau–Fermi liquid theory. In later chapters the discussion gradually turns to more advanced methods used in the theory of strongly correlated systems. The book contains a thorough exposition of such non-perturbative techniques as  $1/N$ -expansion, bosonization (Abelian and non-Abelian), conformal field theory and theory of integrable systems. The book is intended for graduate students, postdoctoral associates and independent researchers working in condensed matter physics.

A unified description of the major soluble and approximate models of relativistic quantum field theory, this compact treatment explores functional methods applicable to relativistic quantum theory and the models themselves. 1972 edition. This modern text combines fundamental principles with advanced topics and recent techniques in a rigorous and self-contained treatment of quantum field theory. Beginning with a review of basic principles, starting with quantum mechanics and special relativity, students can refresh their knowledge of elementary aspects of quantum field theory and perturbative calculations in the Standard Model. Results and tools relevant to many applications are covered, including canonical quantization, path integrals, non-Abelian gauge theories, and the renormalization group. Advanced topics are explored, with detail given on effective field theories, quantum anomalies, stable extended field configurations, lattice field theory, and field theory at a finite temperature or in the strong field regime. Two chapters are dedicated to new methods for calculating scattering amplitudes (spinor-helicity, on-shell recursion, and generalized unitarity), equipping students with practical skills for research. Accessibly written, with numerous worked examples and end-of-chapter problems, this is an essential text for graduate students. The breadth of coverage makes it an equally excellent reference for researchers.

This volume contains the invited lectures of a school on modern quantum field theory held at Alushta, USSR, in May 1989. The development of this subject, including string theories attempting to model elementary particles, is closely interwoven with modern mathematical physics. The lectures presented by experts in the field provide an overview of the research pursued in different branches of this rapidly evolving field and draw attention to particular interconnections and problems. Topics covered include: geometrical quantization and finite size effects in conformal field theory; quasi-Hopf, Kac-Moody current and Lie super-algebras; quantum groups; Wess-Zumino-Witten models; Nizhnik-Zamolodchikov equations; non-archimedean strings; string dynamics; KdV and KP (super) equations and calculations on (super-) riemannian surfaces; 2d Ising model and 2d electron motion on surfaces in external magnetic fields.

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