

Read Online Quantum Field
Theory A Modern Introduction

Quantum Field Theory A Modern Introduction

*An accessible, comprehensive
reference to modern quantum*

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mechanics and field theory. In surveying available books on advanced quantum mechanics and field theory, Franz Gross determined that while established books were outdated, newer titles tended to focus on recent

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developments and disregard the basics. Relativistic Quantum Mechanics and Field Theory fills this striking gap in the field. With a strong emphasis on applications to practical problems as well as calculations, Dr. Gross provides

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complete, up-to-date coverage of both elementary and advanced topics essential for a well-rounded understanding of the field.

Developing the material at a level accessible even to newcomers to quantum mechanics, the book

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begins with topics that every physicist should know- quantization of the electromagnetic field, relativistic one body wave equations, and the theoretical explanation of atomic decay. Subsequent chapters

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prepare readers for advanced work, covering such major topics as gauge theories, path integral techniques, spontaneous symmetry breaking, and an introduction to QCD, chiral symmetry, and the Standard

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Model. A special chapter is devoted to relativistic bound state wave equations-an important topic that is often overlooked in other books. Clear and concise throughout, Relativistic Quantum Mechanics and Field Theory

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boasts examples from atomic and nuclear physics as well as particle physics, and includes appendices with background material. It is an essential reference for anyone working in quantum mechanics today.

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This book develops quantum field theory starting from its foundation in quantum mechanics. Quantum field theory is the basic theory of elementary particle physics. In recent years, many techniques have been developed which

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extend and clarify this theory. This book incorporates these modern methods, giving a thoroughly modern pedagogic account which starts from first principles. The path integral formulation is introduced right at

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the beginning. The method of dimensional continuation is employed to regulate and renormalize the theory. This facilitates the introduction of the concepts of the renormalization group at an early stage. The

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notion of spontaneous symmetry breakdown is also introduced early on by the example of superfluid helium. Topics in quantum electrodynamics are described which have an analog in quantum chromodynamics. Some

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novel techniques are employed, such as the use of dimensional continuation to compute the Lamb shift. Many problems are included.

The book provides a step by step construction of the framework of

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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

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glossed over in other texts.

A collection of problems in QFT, with complete solutions, for graduate students taking their first or second course.

A Modern Course in Quantum Field Theory

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Quantum Field Theory Approach to Condensed Matter Physics

Modern Quantum Field Theory Second Edition

Quantum Field Theory and the Standard Model

This text presents an

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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

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metaphysical postulates. In particular, the book explores a dissipative approach to quantum field theory, which is illustrated for scalar field theory and quantum

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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

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conceptual foundations of quantum field theory and ontological questions. It also suggests a new stochastic simulation technique in quantum field theory which is

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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

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philosophers interested in quantum field theory, and it allows readers to gain an intuitive rather than a formal understanding.

Quantum field theory is the basic mathematical

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framework that is used to describe elementary particles. This textbook provides a complete and essential introduction to the subject. Assuming only an undergraduate knowledge

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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

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with basic concepts illustrated by simple examples, and proceeds through historically important results to thorough treatments of modern topics such as the

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renormalization group, spinor-helicity methods for quark and gluon scattering, magnetic monopoles, instantons, supersymmetry, and the unification of forces. The

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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

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a year-long course given by the author and contains extensive problems, with password protected solutions available to lecturers at www.cambridge.org/9780521864497.

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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

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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

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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

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this edition, a chapter devoted to supersymmetry. Graduate students in particle physics and high energy physics will benefit from this book. The importance and the

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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,

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cosmology, condensed matter, statistical mechanics and critical phenomena. This book introduces the reader to the modern developments in a manner which assumes no

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previous knowledge of quantum field theory. Along with standard topics like Feynman diagrams, the book discusses effective lagrangians, renormalization group

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equations, the path integral formulation, spontaneous symmetry breaking and non-abelian gauge theories. The inclusion of more advanced topics will also make this

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a most useful book for graduate students and researchers.

*The Why, What and How
An Integrated Approach
With Fully-Worked
Solutions*

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Quantum Field Theory: A Modern Perspective
A Concise Introduction
Provides a comprehensive discussion of the gauge revolution and the theoretical and

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experimental evidence which makes the Standard Model the leading theory of subatomic phenomena. Quantum field theory (QFT) provides the framework for many

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fundamental theories in modern physics, and over the last few years there has been growing interest in its historical and philosophical

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foundations. This anthology on the foundations of QFT brings together 15 essays by well-known researchers in physics, the philosophy of

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physics, and analytic philosophy. Many of these essays were first presented as papers at the conference “Ontological Aspects of Quantum Field Theory”,

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***held at the Zentrum für
interdisziplinäre
Forschung (ZiF),
Bielefeld, Germany. The
essays contain cutting-
edge work on ontological
aspects of QFT,***

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including: the role of measurement and experimental evidence, corpuscular versus field-theoretic interpretations of QFT, the interpretation of

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gauge symmetry, and localization. This book is ideally suited to anyone with an interest in the foundations of quantum physics, including physicists,

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philosophers and historians of physics, as well as general readers interested in philosophy or science.
Contents: Approaches to Ontology: Candidate

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***General Ontologies for
Situating Quantum Field
Theory (P
Simons) 'Quanta', Tropes,
or Processes: Ontologies
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of Substance (J***

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Ontologists in Action: A
Comment on Seibt and
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(S Y Auyang)Field***

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***Ontologies for QFT: A
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Covariance in the Interpretation of Quantum Field Theory (D Dieks) Measurement and Ontology: What Kind of Evidence Can We Have for Quantum Fields? (B Falke

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*nburg)Renormalization
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Redhead) Comment on Redhead: The Interpretation of Gauge Symmetry (M Drieschner et al.) Is the Zero-Point Energy Real? (S Saunders) Two Comments on

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*the Vacuum in Algebraic
Quantum Field Theory (M
Rédei) Readership:
Physicists, historians
of physics and
philosophers.*

Keywords: Quantum Field T

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heory; Ontology; Foundations of Physics; Philosophy; Measurement; Gauge Field Theory
Reviews: "A strength of the volume is its inclusion of commentaries and

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***exchanges."Studies in
History and Philosophy
of Modern Physics
An Introduction to
Quantum Field Theory is
a textbook intended for
the graduate physics***

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course covering relativistic quantum mechanics, quantum electrodynamics, and Feynman diagrams. The authors make these subjects accessible

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through carefully worked examples illustrating the technical aspects of the subject, and intuitive explanations of what is going on behind the mathematics.

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After presenting the basics of quantum electrodynamics, the authors discuss the theory of renormalization and its relation to statistical

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mechanics, and introduce the renormalization group. This discussion sets the stage for a discussion of the physical principles that underlie the fundamental

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interactions of elementary particle physics and their description by gauge field theories. Presenting a variety of topics that are only

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briefly touched on in other texts, this book provides a thorough introduction to the techniques of field theory. Covering Feynman diagrams and path

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integrals, the author emphasizes the path integral approach, the Wilsonian approach to renormalization, and the physics of non-abelian gauge theory. It

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provides a thorough treatment of quark confinement and chiral symmetry breaking, topics not usually covered in other texts at this level. The

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Standard Model of particle physics is discussed in detail. Connections with condensed matter physics are explored, and there is a brief, but

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detailed, treatment of non-perturbative semi-classical methods. Ideal for graduate students in high energy physics and condensed matter physics, the book

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contains many problems, which help students practise the key techniques of quantum field theory. Relativistic Quantum Mechanics and Field

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Theory

***Functional Methods and
Models in Quantum Field
Theory***

***Ontological Aspects of
Quantum Field Theory
A Modern Primer***

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Summing Feynman Graphs

The only graduate-level textbook on quantum field theory that fully integrates perspectives from high-energy, condensed-matter, and statistical physics Quantum field theory was originally developed to describe quantum electrodynamics

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and other fundamental problems in high-energy physics, but today has become an invaluable conceptual and mathematical framework for addressing problems across physics, including in condensed-matter and statistical physics. With this expansion of applications has

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come a new and deeper understanding of quantum field theory—yet this perspective is still rarely reflected in teaching and textbooks on the subject.

Developed from a year-long graduate course Eduardo Fradkin has taught for years to students of

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high-energy, condensed-matter, and statistical physics, this comprehensive textbook provides a fully "multicultural" approach to quantum field theory, covering the full breadth of its applications in one volume. Brings together perspectives from high-energy,

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condensed-matter, and statistical physics in both the main text and exercises Takes students from basic techniques to the frontiers of physics Pays special attention to the relation between measurements and propagators and the computation of cross sections and

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response functions Focuses on renormalization and the renormalization group, with an emphasis on fixed points, scale invariance, and their role in quantum field theory and phase transitions Other topics include non-perturbative phenomena,

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anomalies, and conformal invariance Features numerous examples and extensive problem sets Also serves as an invaluable resource for researchers Quantum field theory provides the theoretical backbone to most modern physics. This book is

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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.

"Quantum field theory is the

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mathematical and conceptual framework that describes the physics of the very small, including subatomic particles and quasiparticles. It is used to address a range of problems across subfields, from high-energy physics and gravitation to statistical

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physics and condensed matter physics. Despite the breadth of its applications, however, the teaching of quantum field theory has historically been strongly oriented toward high-energy physics students, while others-particularly in condensed matter and statistical

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physics-are typically taught in a separate course, or take an alternate sequence in many-body and statistical physics. Author Eduardo Fradkin strongly believes that this separation is both artificial and detrimental to all groups' understanding of quantum field

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theory. This textbook, developed from a graduate course Fradkin has taught for decades at the University of Illinois, offers a new, "multicultural" approach to the subject that seeks to remedy this fragmentation. It covers both basic techniques and topics at the

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frontiers of current research, and integrates modern concepts and examples from high-energy, statistical, and condensed-matter physics alike. Extensive problem sets further illustrate applications across a range of subfields. The book will be suitable for students

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***across physical subdisciplines who have mastered graduate-level quantum mechanics, and will be a useful reference for researchers"--
Modern introduction to quantum field theory for graduates, providing intuitive, physical explanations supported by real-world***

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applications and homework problems.

Problems in Quantum Field Theory

Topics In Quantum Field Theory:

Modern Methods In Fundamental Physics

Modern Functional Quantum Field Theory

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Fundamentals. Volume 1 An Introduction

This book describes, in clear terms, the Why, What and the How of Quantum Field Theory. The raison d'etre of QFT is explained by starting from the dynamics of a relativistic particle and demonstrating how it leads to the notion

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of quantum fields. Non-perturbative aspects and the Wilsonian interpretation of field theory are emphasized right from the start. Several interesting topics such as the Schwinger effect, Davies-Unruh effect, Casimir effect and spontaneous symmetry breaking introduce the reader

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to the elegance and breadth of applicability of field theoretical concepts. Complementing the conceptual aspects, the book also develops all the relevant mathematical techniques in detail, leading e.g., to the computation of anomalous magnetic moment of the electron and the two-

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loop renormalisation of the self-interacting scalar field. It contains nearly a hundred problems, of varying degrees of difficulty, making it suitable for both self-study and classroom use. "This volume contains the invited lectures of a school on modern quantum field theory held at Alushta,

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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

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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-

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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."--Publisher's web site. In this second volume of The Quantum

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Theory of Fields, available for the first time in paperback, Nobel Laureate Steven Weinberg continues his masterly exposition of quantum theory. Volume 2 provides an up-to-date and self-contained account of the methods of quantum field theory, and how they have led to an understanding of the

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weak, strong, and electromagnetic interactions of the elementary particles. The presentation of modern mathematical methods is throughout interwoven with accounts of the problems of elementary particle physics and condensed matter physics to which they have been applied. Exercises are

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included at the end of each chapter. 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. Introduction to Quantum Field Theory
Quantum Field Theory

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Advanced Topics

Quantum Field Theory in a Nutshell
A Modern Introduction

"A Modern Course in Quantum Field Theory provides a self-contained pedagogical and constructive presentation of quantum field theory. Here, constructive is not meant in the

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sense of axiomatic field theory, but it is merely used in the sense that all results must be obtained by an explicit set of calculations from accepted premises by those who start to learn this subject. Written for advanced students the work provides complete material for a two or three semester

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course, and includes numerous problem exercises, some with detailed solutions." -- Prové de l'editor.

Providing a broad review of many techniques and their application to condensed matter systems, this book begins with a review of thermodynamics and statistical

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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,

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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

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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.

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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

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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

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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

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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

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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,

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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

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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.

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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.

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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

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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

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Physics, Rockefeller University, Institute for Advanced Study at Princeton, and Massachusetts Institute of Technology.

These pages offer a simple, analytic, functional approach to non-perturbative QFT, using a frequently overlooked functional representation of

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Fradkin to explicitly calculate relevant portions of the Schwinger Generating Functional (GF). In QED, this corresponds to summing all Feynman graphs representing virtual photon exchange between charged particles. It is then possible to see, analytically, the cancellation of an infinite number

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of perturbative, UV logarithmic divergences, leading to an approximate but most reasonable statement of finite charge renormalization. A similar treatment of QCD, with the addition of a long-overlooked but simple rearrangement of the Schwinger GF which displays

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Manifest Gauge Invariance, is then able to produce a simple, analytic derivation of quark-binding potentials without any approximation of infinite quark masses. A crucial improvement of previous QCD theory takes into account the experimental fact that asymptotic quarks are always found in

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bound states; and therefore that their transverse coordinates can never be measured, nor specified, exactly. And this change of formalism permits a clear and simple realization of true quark binding, into mesons and nucleons. An extension into the QCD binding of two nucleons into an

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effective deuteron presents a simple, analytic derivation of nuclear forces. Finally, a new QED-based solution of Vacuum Energy is displayed as a possible candidate for Dark Energy. An obvious generalization to include Inflation, which automatically suggests a model for Dark Matter, is

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immediately possible; and one more obvious generalization produces an understanding of the origin of the Big Bang, and of the Birth (and Death) of a Universe. If nothing else, this illustrates the Power and the Reach of Quantum Field Theory. Contents:Basic Preliminaries:Quantum Field Theory □

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Why and How
Functional Preliminaries
Functional Field Theory
The Generating Functional and the S-Matrix
Schwinger/Fradkin Representations
Quantum Electrodynamics:
Radiative Corrections of the Photon Propagator
Radiative Corrections to the Electron

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Propagator
A QED Symmetry-Breaking Model of Vacuum Energy
Quantum Chromodynamics: Explicit, Non-Perturbative Gauge Invariance
QCD Transverse Fluctuations
Quark Binding Potential
Nucleon Scattering and Binding
Astrophysical Speculations: Inflation as the Precursor

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of Dark Energy Quantum Tachyon Dynamics Readership: Graduate students and researchers in quantum field theory. Keywords: Functional Methods; Quantum Field Theory; Non-Perturbative QED and QCD Key Features: Contains an explicit, non-perturbative QED argument

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suggesting that charge renormalization is finite Contains an explicit, new, gauge-invariant formulation of QCD, including an analytic derivation of quark binding potentials, and the first analytic extraction of Nuclear Physics from fundamental QCD: a deuteron-like potential which can bind two

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nucleons
Contains a set of QFT
Conjectures and their Astrophysical
Consequences

Modern Quantum Field Theory II

The Quantum Theory of Fields:

Volume 2, Modern Applications

Quantum Field Theory for the Gifted
Amateur

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A Modern Introduction to Quantum Field Theory

Markov Chain Monte Carlo Methods in Quantum Field Theories

Quantum Field Theory has become the universal language of most modern

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theoretical physics.

This introductory textbook shows how this beautiful theory offers the correct mathematical framework to describe and understand the

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fundamental interactions of elementary particles. The book begins with a brief reminder of basic classical field theories, electrodynamics and

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general relativity, as well as their symmetry properties, and proceeds with the principles of quantisation following Feynman's path integral approach. Special care

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is used at every step to illustrate the correct mathematical formulation of the underlying assumptions. Gauge theories and the problems encountered in

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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

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it, such as grand unified theories and supersymmetry. Written for advanced undergraduate and beginning graduate students in physics and

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mathematics, the book could also serve as a reference for active researchers in the field.

This book deals with quantum field theory,

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the language of modern elementary particles physics. Based on university lectures given by the author, this volume provides a detailed technical

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treatment of quantum field theory that is particularly useful for students; it begins with the quantization of the most important free fields, the scalar, the

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spin-1/2 and the photon fields, and is then followed by a detailed account of symmetry properties, including a discussion on global and local symmetries and the

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spontaneous breaking of symmetries. Perturbation theory, one-loop effects for quantum electrodynamics, and renormalization properties are also

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covered. In this second edition new chapters have been introduced with a general description of path integral quantization both on quantum

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mechanics and in quantum field theory, with a particular attention to the gauge fields. The path integral quantization of Fermi fields is also

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discussed. Request
Inspection Copy

The proceedings reflect
a broad spectrum of
topics in contemporary
theoretical physics:
quantum aspects of black

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holes; recent progress in critical and noncritical string theory; spin chains quantum hall effect and generalized statistics; stochastic dynamics

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turbulence and reaction kinetics; foundations of quantum mechanics; new statistics in field theory; quantum field theory on Riemann surfaces and knot

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theory; lattice field theories. The lectures present developments in the frontiers of these subjects and provide interdisciplinary links between the areas.

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**Contents: Black Holes and
Quantum Gravity String
Theory Condensed Matter
and Statistical
Mechanics Fundamental
Aspects of Quantum
Mechanics and Quantum**

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**Field Theory Mathematics
and Quantum Field
Theory Integrable
Models Lattice Field
Theory Readership:
Researchers and graduate
students in physics and**

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mathematics. keywords:

This book constitutes the proceedings of a meeting which brought together contributors from the four European networks in the area of

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the theory of fundamental interactions. While each of these networks overlaps strongly with all the others, this coming together gives

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the proceedings a greater than usual breadth of subjects nevertheless. The wide range of topics in quantum field theory covered includes

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Hamiltonian and
semiclassical methods,
critical phenomena and
various aspects of
classical and quantum
gravity including also a
study in the detection

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of gravitational radiation. This, together with the leading item on the recent history of the subject, gives an overall perspective of

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the many new research directions in this area. The Conceptual Framework of Quantum Field Theory Quantum Field Theory and Condensed Matter Quantum Field Theory of

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**Many-Body Systems
Proceedings of the
International Colloquium
(Second Edition)**

**A concise, beginner-friendly
introduction to quantum field theory
Quantum field theory is a powerful**

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framework that extends quantum mechanics in ways that are essential in many modern applications. While it is the fundamental formalism for the study of many areas of physics, quantum field theory requires a different way of thinking, and many

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newcomers to the subject struggle with the transition from quantum mechanics. A Prelude to Quantum Field Theory introduces the key concepts of quantum field theory in a brief and accessible manner while never sacrificing mathematical rigor. The result is an easy-to-use

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textbook that distills the most general properties of the theory without overwhelming beginning students with more advanced applications. Bridges quantum mechanics and quantum field theory, emphasizing analogies and differences Emphasizes a “quantum

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field theoretical mindset” while maintaining mathematical rigor Obtains quantum fields as the continuum limit of a quantized system of many particles Highlights the correspondence between wave function—fundamental in quantum mechanics—and the formalism of

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second quantization used in quantum field theory Provides a step-by-step derivation of Feynman rules for the perturbative study of interacting theories Introduces students to renormalization, path integrals techniques, and more Discusses more modern topics like

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effective field theories Ideal for both undergraduate and graduate students Proven in the classroom A balanced combination of introductory and advanced topics provides a new and unique perspective on the quantum field theory approach to condensed

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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

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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,

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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

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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.

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The Problem Book in Quantum Field Theory contains about 200 problems with solutions or hints that help students to improve their understanding and develop skills necessary for pursuing the subject. It deals with the Klein-Gordon and Dirac equations, classical field

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theory, canonical quantization of scalar, Dirac and electromagnetic fields, the processes in the lowest order of perturbation theory, renormalization and regularization. The solutions are presented in a systematic and complete manner. The material covered and the level

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of exposition make the book appropriate for graduate and undergraduate students in physics, as well as for teachers and researchers.

For most of the last century, condensed matter physics has been dominated by band theory and

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Landau's symmetry breaking theory. In the last twenty years, however, there has been the emergence of a new paradigm associated with fractionalisation, topological order, emergent gauge bosons and fermions, and string condensation. These new physical

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concepts are so fundamental that they may even influence our understanding of the origin of light and fermions in the universe. This book is a pedagogical and systematic introduction to the new concepts and quantum field theoretical methods (which have

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fuelled the rapid developments) in condensed matter physics. It discusses many basic notions in theoretical physics which underlie physical phenomena in nature. Topics covered are dissipative quantum systems, boson condensation, symmetry breaking

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and gapless excitations, phase transitions, Fermi liquids, spin density wave states, Fermi and fractional statistics, quantum Hall effects, topological and quantum order, spin liquids, and string condensation. Methods covered are the path integral, Green's functions,

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mean-field theory, effective theory, renormalization group, bosonization in one- and higher dimensions, non-linear sigma-model, quantum gauge theory, dualities, slave-boson theory, and exactly soluble models beyond one-dimension. This book is aimed at

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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

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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

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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

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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

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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

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

This book discusses the main concepts of the Standard Model of elementary particles

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in a compact and straightforward way. The work illustrates the unity of modern theoretical physics by combining approaches and concepts of the quantum field theory and modern condensed matter theory. The

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inductive approach allows a deep understanding of ideas and methods used for solving problems in this field.

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