[Book] Lectures On Field Theory The Many Body

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Lectures On Quantum Field Theory (Second Edition) - Ashok Das - 2020-07-24
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.

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The first volume of the Brandeis University Summer Institute lecture series of 1970 on theories of interacting elementary particles, consisting of four sets of lectures. Every summer since 1959 Brandeis University has conducted a lecture series centered on various areas of theoretical physics. The areas are sufficiently broad to interest a large number of physicists and the lecturers are among the original explorers of these areas. The 1970 lectures, presented in two volumes, are on theories of interacting elementary particles. The four lecturers of Volume 1, and the range of the topics they cover, are as follows: Stephen L. Adler (Institute for Advanced Study) on "Perturbation Theory Anomalies": introduction and review of perturbation theory; the VVA triangle anomaly; absence of radiative corrections; generalizations of our results; connection between Ward identity anomalies and commutator (Bjorken-limit) anomalies; applications of the Bjorken limit; and breakdown of the Bjorken limit in perturbation theory. Stanley Mandelstam (University of California at Berkeley) on "Dynamical Applications of the Veneziano formula for the four-point scalar amplitude; factorization; the operator formalism; Veneziano-type quark models; and higher-order Feynman-like diagrams. Steven Weinberg (Massachusetts Institute of Technology) on "Dynamic and Algebraic Symmetries": Introduction; hadron electrodynamics; local symmetries; and chirality. Wolfhart Zimmermann (New York University) on "Local Operator Products and Renormalization in Quantum Field Theory": introduction; renormalization; operator product expansions; and local field equations. The second volume contains lectures by Rudolf Haag on observables and fields, by Maurice Jacob on duality, by Michael Reed on non-Fock representations, and by Bruno Zumino on effective Lagrangians and broken symmetries.

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Lectures on Quantum Mechanics and Relativistic Field Theory - P.A.M. Dirac - 2012-07-01
2012 Reprint of 1955 Edition. Exact facsimile of the original edition, not reproduced with Optical Recognition Software. Dirac is widely regarded as one of the world's greatest physicists. He was one of the founders of quantum mechanics and quantum electrodynamics. His early contributions include the modern operator calculus for quantum mechanics, which he called transformation theory, and an early version of the path integral. His relativistic wave equation for the electron was the first successful attack on the problem of relativistic quantum mechanics. Dirac founded quantum field theory with his reinterpretation of the Dirac equation as a many-body equation, which predicted the existence of antimatter and matter-antimatter annihilation. He was the first to formulate quantum electrodynamics, although he could not calculate arbitrary quantities because the short distance limit requires renormalization. Dirac discovered the magnetic monopole solutions, the first topological configuration in physics, and used them to give the modern explanation of charge quantization. He developed constrained quantization in the 1960s, identifying the general quantum rules for arbitrary classical systems. These lectures were given delivered and published during his tenure at Princeton's Institute for Advanced Study in the 1930's.

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The lectures featured in this book treat fundamental concepts necessary for understanding the physics behind these mathematical applications. Freed approaches the topic with the assumption that the basic notions of supersymmetric field theory are unfamiliar to most mathematicians. He presents the material intending to impart a firm grounding in the elementary ideas.

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Geometric and Topological Methods for Quantum Field Theory - Hernan Ocampo - 2005-06-13
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Modern experimental developments in condensed matter and ultracold atom physics present formidable challenges to theorists. This book provides a pedagogical introduction to quantum field theory in many-particle physics, emphasizing the applicability of the formalism to concrete problems. This second edition contains two new chapters developing path integral approaches to classical and quantum nonequilibrium phenomena. Other chapters cover a range of topics, from the introduction of many-body techniques and functional integration, to renormalization group methods, the theory of response functions, and topology. Conceptual aspects and formal methodology are emphasized, but the discussion focuses on practical experimental applications drawn largely from condensed matter physics and neighboring fields. Extended and challenging problems with fully worked solutions provide a bridge between formal manipulations and research-oriented thinking. Aimed at elevating graduate students to a level where they can engage in independent research, this book complements graduate level courses on many-particle theory.

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Introduction to Conformal Field Theory - Ralph Blumenhagen - 2009-07-11
Based on class-tested notes, this text offers an introduction to Conformal Field Theory with a special emphasis on computational techniques of relevance for String Theory. It introduces Conformal Field Theory at a basic level, Kac-Moody algebras, one-loop partition functions, Superconformal Field Theories, Gepner Models and Boundary Conformal Field Theory. Eventually, the concept of orientifold constructions is explained in detail for the example of the bosonic string. In providing many detailed CFT calculations, this book is ideal for students and scientists intending to become acquainted with CFT techniques relevant for string theory but also for students and non-specialists from related fields.

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Lectures on Tensor Categories and Modular Functors - Bojko Bakalov - 2001
This book gives an exposition of the relations among the following three topics: monoidal tensor categories (such as a category of representations of a quantum group), 3-dimensional topological quantum field theory, and 2-dimensional modular functors (which naturally arise in 2-dimensional conformal field theory). The following examples are discussed in detail: the category of representations of a quantum group at a root of unity and the Wess-Zumino-Witten modular functor. The idea that these topics are related first appeared in the physics literature in the study of quantum field theory. Pioneering works of Witten and Moore-Seiberg triggered an avalanche of papers, both physical and mathematical, exploring various aspects of these relations. Upon preparing to lecture on the topic at MIT, however, the authors discovered that the existing literature was difficult and that there were gaps to fill. The text is wholly expository and finely succinct. It gathers results, fills existing gaps, and simplifies some proofs. The book makes an important addition to the existing literature on the topic. It would be suitable as a course text at the advanced-graduate level.

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Naturalness, String Landscape and Multiverse - Arthur Hebecker - 2021-03-26
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A Mathematical Introduction to Conformal Field Theory - Martin Schottenloher - 2008-09-15
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The Quantum Hall Effect - Richard E. Prange - 2012-12-06
After a foreword by Klaus von Klitzing, the first chapters of this book discuss the prehistory and the theoretical basis as well as the implications of the discovery of the Quantum Hall effect on superconductivity, superfluidity, and metrology, including experimentation. The second half of this volume is concerned with the theory of and experiments on the many body problem posed by fractional effect. Specific unsolved problems are mentioned throughout the book and a summary is made in the final chapter. The quantum Hall effect was discovered on about the hundredth anniversary of Hall's original work, and the finding was announced in 1980 by von Klitzing, Dorda and Pepper. Klaus von KIitzing was awarded the 1985 Nobel prize in physics for this discovery.

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ITEP Lectures on Particle Physics and Field Theory - Mikhail A. Shifman - 1999

Lecture Notes on Chern-Simons-Witten Theory - Sen Hu - 2001
This invaluable monograph has arisen in part from E Witten's lectures on topological quantum field theory in the spring of 1989 at Princeton University. At that time Witten unified several important mathematical works in terms of quantum field theory, most notably the Donaldson polynomial, the Gromov-Floer homology and the Jones polynomials.In his lectures, among other things, Witten explained his intrinsic three-dimensional construction of Jones polynomials via Chern-Simons gauge theory. He provided both a rigorous proof of the geometric quantization of the Chern-Simons action and a very illuminating view as to how the quantization arises from quantization of the space of connections. He constructed a projective flat connection for the Hilbert space bundle over the space of complex structures, which becomes the Knizhik-Zamolodchikov equations in a special case. His construction leads to many beautiful applications, such as the derivation of the skein relation and the surgery formula for knot invariant, a proof of Verlinde's formula, and the establishment of a connection with conformal field theory.In this book, Sen Hu has added material to provide some of the details left out of Witten's lectures and to update some new developments. In Chapter 4 he presents a construction of knot invariant via representation of mapping class groups based on the work of Moore-Seiberg and Kohno. In Chapter 6 he offers an approach to constructing knot invariant from string theory and topological sigma models proposed by Witten and Vafa. The localization principle is a powerful tool to build mathematical foundations for such cohomological quantum field theories.In addition, some highly relevant material by S S Chern and E Witten has been included as appendices for the convenience of readers: (1) Complex Manifold without Potential Theory by S S Chern, pp148-154. (2) "Geometric quantization of Chern-Simons gauge theory" by S Axelrod, S D Pietra and E Witten. (3) "On holomorphic factorization of WZW and Coset models" by E Witten.

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Diagrammatica - Martinus Veltman - 1994-06-16
This author provides an easily accessible introduction to quantum field theory via Feynman rules and calculations in particle physics. His aim is to make clear what the physical foundations of present-day field theory are, to clarify the physical content of Feynman rules. The book begins with a brief review of some aspects of Einstein's theory of relativity that are of particular importance for field theory, before going on to consider the relativistic quantum mechanics of free particles, interacting fields, and particles with spin. The techniques learnt in the chapters are then demonstrated in examples that might be encountered in real accelerator physics. Further chapters contain discussions of renormalization, massive and massless vector fields and unitarity. A final chapter presents concluding arguments concerning quantum electrodynamics. The book includes valuable appendices that review some essential mathematics, including complex spaces, matrices, the CBH equation, traces and dimensional regularization. An appendix containing a comprehensive summary of the rules and conventions used is followed by an appendix specifying the full Lagrangian of the Standard Model and the corresponding Feynman rules. To make the book useful for a wide audience a final appendix provides a discussion of the metric used, and an easy-to-use dictionary connecting equations written with different metrics. Written as a textbook, many diagrams, exercises and examples are included. This book will be used by beginning graduate students taking courses in particle physics or quantum field theory, as well as by researchers as a source and reference book on Feynman diagrams and rules.

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Lectures on Elementary Particles and Quantum Field Theory - Brandeis University Summer Institute in Theoretical Physics - 1970

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Quantum Fields and Strings - Pierre Deligne - 1999
Ideas from quantum field theory and string theory have had considerable impact on mathematics since the 1980s. Advances in many different areas have been inspired by insights from physics. In 1996-97 the Institute for Advanced Study (Princeton, NJ) organized a special year-long programme designed to teach mathematicians the basic physical ideas which underlie the mathematical applications.

Introduction to Effective Field Theory - C. P. Burgess - 2020-11-30
This advanced, accessible textbook on effective field theories uses worked examples to bring this important topic to a wider audience.

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Three Lectures on Complexity and Black Holes - Leonard Susskind - 2020-05-11
These three lectures cover a certain aspect of complexity and black holes, namely the relation to the second law of thermodynamics. The first lecture describes the meaning of quantum complexity, the analogy between entropy and complexity, and the second law of complexity. Lecture two reviews the connection between the second law of complexity and the interior of black holes. Prof. L. Susskind discusses how firewalls are related to periods of non-increasing complexity which typically only occur after an exponentially long time. The final lecture is about the thermodynamics of complexity, and “uncomplexity” as a resource for doing computational work. The author explains the remarkable power of “one clean qubit,” in both computational terms and in space-time terms. This book is intended for graduate students and researchers who want to take the first steps towards the mysteries of black holes and their complexity.

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Lectures on Classical and Quantum Theory of Fields - Henryk Arodz - 2014-11-12
This textbook on classical and quantum theory of fields addresses graduate students starting to specialize in theoretical physics. It provides didactic introductions to the main topics in the theory of fields, while taking into account the contemporary view of the subject. The student will find concise explanations of basic notions essential for applications of the theory of fields as well as for frontier research in theoretical physics. One third of the book is devoted to classical fields. Each chapter contains exercises of varying degree of difficulty with hints or solutions, plus summaries and worked examples as useful. The textbook is based on lectures delivered to students of theoretical physics at Jagiellonian University. It aims to deliver a unique combination of classical and quantum field theory in one compact course.

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