Quarks Lepton And Gauge Fields

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Foundations of the Hyperunified Field Theory - Yue-Liang Wu

Masses And Mixings Of Quarks And Leptons - Koide Yoshio 1998-03-04
It is widely accepted that quarks and leptons should be understood on the basis of the same unification scheme. The investigation of hidden rules behind observed quark and lepton mass spectra will provide a very important clue to a unified model of quarks and leptons. Now the investigation is timely because of the recent abundance of data on the CKM matrix elements and neutrino mixings. This volume offers useful information and hints on a unified understanding of quarks and leptons.
Quarks and Leptons From Orbifolded Superstring - Kang-Sin Choi 2006-09-10
This book offers a detailed guide on the journey towards the minimal supersymmetric standard model down the orbifold road. It takes the viewpoint that the chirality of matter fermions is an essential aspect that orbifold compactification allows to derive from higher-dimensional string theories in a straightforward manner. Halfway between textbook and tutorial review, the book is intended for the graduate student and particle phenomenologist wishing to get acquainted with this field.
Unification and Supersymmetry - Rabindra N. Mohapatra 2013-06-29
The theoretical understanding of elementary particle interactions has under gone a revolutionary change during the past one and a half decades. The spontaneously broken gauge theories, which in the 1970s emerged as a prime candidate for the description of electro-weak (as well as strong) interactions, have been confirmed by the discovery of neutral weak currents as well as the w- and Z-bosons. We now have a field theory of electro-weak interactions at energy scales below 100 GeV-the Glashow-Weinberg-Salam theory. It is a renormalizable theory which enables us to do calculations without en countering unnecessary divergences. The burning question now is: Wh at lies ahead at the next level of unification? As we head into the era of supercolliders and ultrahigh energy machines to answer this question, many ap, pealing possi bilities exist: left-right symmetry, technicolor, compositeness, grand unifica ti on, supersymmetry, supergravity, Kaluza-Klein models, and most recently superstrings that even unify gravity along with other interactions. Experi ments will decide if any one or any combination of these is to be relevant in the description of physics at the higher energies. As an outcome of our con fidence in the possible scenerios for elementary particle physics, we have seen our understanding of the early uni verse improve significantly.
Particles and Fields 2 - Anton Z. Capri 2013-11-11
Particle physics seems to be entering a new period of consoli dation. In 1977 when the first summer institute on particles and fields was held at the Banff Center, the standard model of the electro-weak interaction was a promising model more or less con firmed; today it seems quite well-confirmed. QCD was considered as probably the correct theory of strong interactions; today most theo rists take it for granted. What seems to be lacking are computa tional tools and strenuous experimental testing; the major ideas seem to exist. Thus, this is a particularly auspicious time for a review of the status of theoretical and experimental particle physics and field theory. The lectures collected in this volume were presented from August 16 to August 27, 1981 at the Banff Center in Banff, Canada. The unifying theme was gauge fields and the topics covered dealt with electro-weak interactions, Q.C.D., sub-quarks and unified theories. The format of the Institute was as follows: thirteen lecture series of two to four hours each given by S. Brodsky, D. Bryman, M. Chen, S. Coleman, M. Creutz, H. Harari, J. Iliopoulos, C.H. Llewellyn Smith, P. Lepage, D. Perkins and L. Susskind. In addition there were nine seminars (one hour each) given by G. Bodwin, G. Bunce, M.
Gauge Theories in Particle Physics: A Practical Introduction, Volume 2: Non-Abelian Gauge Theories - Ian J R Aitchison 2012-12-17
Volume 2 of this revised and updated edition provides an accessible and practical introduction to the two non-Abelian quantum gauge field theories of the Standard Model of particle physics: quantum chromodynamics (QCD) and the Glashow-Salam-Weinberg (GSW) electroweak theory. This volume covers much of the experimental progress made in the last ten years. A new chapter on CP violation and oscillation phenomena describes CP violation in B-meson decays as well as the main experiments that have led to our current knowledge of mass-squared differences and mixing angles in neutrino physics. Exploring a new era in particle physics, this edition discusses one of the most recent and exciting breakthroughs—the discovery of a boson with properties consistent with those of the Standard Model Higgs boson. It also updates many other topics, including jet algorithms, lattice QCD, effective Lagrangians, and three-generation quark mixing and the CKM matrix. New to the Fourth Edition New chapter on CP violation and oscillations in mesonic and neutrino systems New section on three-generation quark mixing and the CKM matrix Improved discussion of two-jet cross section in electron-positron annihilation New section on jet algorithms Recent lattice QCD calculations with dynamical fermions New section on effective Lagrangians for spontaneously broken chiral symmetry, including the three-flavor extension, meson mass relations, and chiral perturbation theory Update of asymptotic freedom Discussion of the historic discovery of a Higgs-like boson The authors discuss the main conceptual points of the theories, detail many practical calculations of physical quantities from first principles, and compare these quantitative predictions with experimental results, helping readers improve both their calculation skills and physical insight.
50 Years of Quarks - Harald Fritzsch 2015-03-11
Today it is known that the atomic nuclei are composed of smaller constituents, the quarks. A quark is always bound with two other quarks, forming a baryon or with an antiquark, forming a meson. The quark model was first postulated in 1964 by Murray Gell-Mann — who coined the name “quark” from James Joyce's novel Finnegans Wake — and by George Zweig, who then worked at CERN. In the present theory of strong interactions — Quantum Chromodynamics proposed by H Fritzsch and Gell-Mann in 1972 — the forces that bind the quarks together are due to the exchange of eight gluons. On the 50th anniversary of the quark model, this invaluable volume looks back at the developments and achievements in the elementary particle physics that eventuated from that beautiful model. Written by an international team of distinguished physicists, each of whom have made major developments in the field, the volume provides an essential overview of the present state to the academics and researchers. Contents:A Schematic Model of Baryons and Mesons (M Gell-Mann)Quarks (M Gell-Mann)Concrete Quarks (G Zweig)On the Way from Sakatons to Quarks (L B Okun)My Life with Quarks (S L Glashow)Quarks and the Bootstrap Era (D Horn)From Symmetries to Quarks and Beyond (S Meshkov)How I Got to Work with Feynman on the Covariant Quark Model (F Ravndal)What is a Quark? (G L Kane & M J Perry)Insights and Puzzles in Particle Physics (H Leutwyler)Quarks and QCD (H Fritzsch)The Discovery of Gluon (J Ellis)Discovery of the Gluon (S L Wu)The Parton Model and Its Applications (T M Yan & S D Drell)From Old Symmetries to New Symmetries: Quark, Leptons and B — L (R N Mohapatra)Quark Mass Hierarchy and Flavor Mixing Puzzles (Z-Z Xing)Analytical Determination of the QCD Quark Masses (C Dominquez)CP Violation in Six Quarks Scheme — Legacy of Sakata Model (M Kobayashi)The

Constituent-Quark Model — Nowadays (W Plessas)From Ω- to Ωb, Doubly Heavy Baryons and Exotics (M Karliner)Quark Elastic Scattering as a Source of High Transverse Momentum Mesons (R Field)Exclusive Processes and the Fundamental Structure of Hadrons (S J Brodsky)Quark-Gluon Soup — The Perfectly Liquid Phase of QCD (U Heinz)Quarks and Anomalies (R J Crewther)Lessons from Supersymmetry: "Instead-of-Confinement" Mechanism (M Shifman & A Yung)Quarks and a Unified Theory of Nature Fundamental Forces (I Antoniadis)SU(8) Family Unification with Boson-Fermion Balance (S L Adler) Readership: Academics and researchers interested in elementary particle physics.
Keywords:Quark;Gluon;Baryon;Meson;Hadron;Elementary Particles;QCD

An Informal Introduction to Gauge Field Theories - Ian J. R. Aitchison 2007-09-27

Four forces are dominant in physics: gravity, electromagnetism and the weak and strong nuclear forces. Quantum electrodynamics - the highly successful theory of the electromagnetic interaction - is a gauge field theory. In this short book Dr Aitchison gives an introduction to these theories, a knowledge of which is essential in understanding modern particle physics.

Fields, Symmetries, and Quarks - Ulrich Mosel 2013-03-14

This revised and extended edition of the book Fields, Symmetries, and Quarks, originally published by McGraw-Hill Book Company, Hamburg, 1989, contains a new chapter on electroweak interactions which has also grown out of lectures that I have given in the meantime. In addition, a number of changes, mainly in the metric used, in the discussion of the theory of strong interactions, QCD, and in the chapter on hadron physics, have been made and errors have been corrected. The motivation for this book, however, is still the same as it was 10 years ago: This is a book on quantum field theory and our present understanding of leptons and hadrons for advanced students and the non-specialists and, in particular, the experimentalists working on problems of nuclear and hadron physics. I am grateful to Dr. S. Leupold for a very careful reading of the revised manuscript, many corrections, and helpful suggestions and to C. Traxler for producing the figures and for constructive discussions.

Quarks and Leptones - Francis Halzen 1984-01-20

This self-contained text describes breakthroughs in our understanding of the structure and interactions of elementary particles. It provides students of theoretical or experimental physics with the background material to grasp the significance of these developments.

Electroweak Interactions - Peter Renton 1990-02-22

A graduate-level description of how the theory of electroweak interactions, or so-called "Standard Model" unifies the weak and electromagnetic forces of nature in high energy physics.

It's All Elementary - Necia H. Apfel 1985

Traces the search leading to the discovery of the smallest bits of matter, pieces too small to be subdivided, and discusses recent developments in the field of particle physics, or study of the invisible microworld of elementary particles.

Gauge Field Theories - Paul H. Frampton 2008-09-08

The first edition of this necessary reading for cosmologists and particle astrophysicists was quickly adopted by universities and other institutions of higher learning around the world. And with the data and references updated throughout, this third edition continues to be an ideal reference on the subject. The tried-and-tested logical structuring of the material on gauge invariance, quantization, and renormalization has been retained, while the chapters on electroweak interactions and model building have been revised. Completely new is the chapter on conformality. As in the past, Frampton emphasizes formalism rather than experiments and provides sufficient detail for readers wishing to do their own calculations or pursue theoretical physics research.

Preons - I A D'Souza 1992-10-29

There are a number of unanswered questions which indicate that the Standard Model, successful as it is, cannot be the entire story. One solution to answering these questions is that the Standard Model is an effective low-energy theory of structure hopefully nearby in its energy scale in much the same way that a model of strong interactions among nucleons mediated by pions is an effective theory for the strong interactions of quarks mediated by coloured gluons. This book reviews the Standard Model and then examines the current status of composite models. After developing criteria for judging such models the text discusses two of the major indicators of compositeness, triviality and naturalness. Using this framework as a background the various models are summarized and discussed. This monograph concludes with a chapter describing the constraints imposed on composite models by current measurements of decay rates, magnetic moment measurements, flavour changing processes etc. and describing other ways to look for signatures of compositeness. This monograph attempts to be thorough, covering all aspects of composite models, as found in the literature at the time of completion of the manuscript. As such it should be of interest to any experimental or theoretical physicist having an interest in the subject. The review of the Standard Model in the first chapter is written in such a way that anyone with a basic knowledge of Quantum Field Theory should be able to understand the entire text. As such it could also be used for supplementary reading in graduate courses. Contents: IntroductionThe Standard ModelThe Leptonic SectorThe Quark SectorA Brief Note on MassesThe Higgs Mechanism/Spontaneous Symmetry BreakingThe Goldstone PhenomenaThe Higgs in the Standard ModelLooking for Alternatives to the Standard ModelGrand Unification TheoriesCriteria for Judging a Composite ModelUnsolved Problems of the Standard ModelComposite Higgs BosonsTrivialityNaturalnessTechnicolorMass for the FermionsThe Composite Higgs ModelQuark and Lepton Sub-StructureThe Compositeness ScaleMasses of Bound State FermionsChiral Protection, t'Hooft Anomaly Matching ConditionsThe Quasi-Goldstone Fermion MechanismMass Generation/Family ReplicationQuark and Lepton Substructure ModelsComposite Weak BosonsAn Alternative Picture of the Weak InteractionsIncorporating Parity ViolationThe Suzuki ModelProspects of W, Z CompositenessExperimental Constraints on Quark/Lepton Sub-StructureLimits on Fermion CompositenessMagnetic Moments of Quarks and LeptonsRare ProcessesCosmic Beams as Quark/Lepton Structure Probes Readership: Theoretical physicists and high energy physicists.
keywords:Preon;Rishon;Haplon;Hypercolor;Subquark;Sublepton;Substructure;Composite;Naturalness;Triviality

Los Alamos Science - 1984

Quarks and Leptons as Fundamental Particles - Paul Urban 2013-03-13

The main task of an experimental talk at a theoreticians school should probably be a tempering one. In this respect, e+e- physics may have been a bad choice. The field has so rapidly developed and dis coveries are chasing each other that much of the optimism of theory has passed over to e+e- experimentalists. A vast amount of experimental material arose from the simple reaction of e+e- annihilation. I, therefore, have to limit myself to recent results - most of them less than one year old. The paper will be organized as follows: In the first lecture (chapter I and II) I will give - a short introduction to e e machines and cross sections. In particular I will discuss the total cross section an- after a short summary on charm - concentrate on the third generation of auarks and leptons: the heavy lepton T and the T family. In my second lecture the various aspects of event topologies in the DORIS energy range will be discussed, including the T decay. In the third lecture I will then describe the new storage ring PETRA and present first results on QED checks, total cross section, jet structure, and two-photon processes.

Modern Elementary Particle Physics - Gordon Kane 2017-02-09

An updated edition on the now completed Structural Model, providing an invaluable synthesis of cutting-edge research for students and scientists.

Quarks, Leptons, and Beyond - H. Fritzsch 2013-06-29

The ASI Quarks, Leptons and Beyond, held in Munich from the 5th to the 16th of September 1983 was dedicated to the study of what we now believe are the fundamental building blocks of nature: quarks and leptons. The subject was approached on two levels. On the one hand, a thorough discussion was given of the status of our knowledge of quarks and leptons and their interactions, both from an experi mental and a theoretical standpoint. On the other hand, open problems presented by the so called standard model of quark and lepton interact ions were explored along various ways that lead one beyond this frame work. One of the principal predictions of the standard model is that weak interactions are mediated by heavy Wand Z vector bosons. These particles were discovered in 1983 at CERN and their relevant proper ties were discussed at the ASI by C. Rubbia. Further theoretical predictions concerning these Z and W bosons, yet to be checked by future experimentation, were discussed by G. Altarelli with a view of seeing where the

standard model might fail and new physics ensue. The strong interactions of quarks, based on Quantum Chromodynamics (QeD), are presumed to cause the quarks to bind into hadrons. Pro gress in attempts to calculate the observed hadronic spectrum, ab initio, starting from QCD and employing lattice methods were reviewed at the ASI by P. Hasenfratz.

Conceptual Foundations of Modern Particle Physics - Robert E Marshak 1993-03-31

For scientific, technological and organizational reasons, the end of World War II (in 1945) saw a rapid acceleration in the tempo of discovery and understanding in nuclear physics, cosmic rays and quantum field theory, which together triggered the birth of modern particle physics. The first fifteen years (1945–60) following the war's end — the “Startup Period” in modern particle physics -witnessed a series of major experimental and theoretical developments that began to define the conceptual contours (non-Abelian internal symmetries, Yang-Mills fields, renormalization group, chirality invariance, baryon-lepton symmetry in weak interactions, spontaneous symmetry breaking) of the quantum field theory of three of the basic interactions in nature (electromagnetic, strong and weak). But it took another fifteen years (1960-75) — the “Heroic Period” in modern particle physics — to unravel the physical content and complete the mathematical formulation of the standard gauge theory of the strong and electroweak interactions among the three generations of quarks and leptons. The impressive accomplishments during the “Heroic Period” were followed by what is called the “period of consolidation and speculation (1975–1990)”, which includes the experimental consolidation of the standard model (SM) through precision tests, theoretical consolidation of SM through the search for more rigorous mathematical solutions to the Yang-Mills-Higgs equations, and speculative theoretical excursions “beyond SM”. Within this historical-conceptual framework, the author — himself a practicing particle theorist for the past fifty years — attempts to trace the highlights in the conceptual evolution of modern particle physics from its early beginnings until the present time. Apart from the first chapter — which sketches a broad overview of the entire field — the remaining nine chapters of the book offer detailed discussions of the major concepts and principles that prevailed and were given wide currency during each of the fifteen-year periods that comprise the history of modern particle physics. Those concepts and principles that contributed only peripherally to the standard model are given less coverage but an attempt is made to inform the reader about such contributions (which may turn out to be significant at a future time) and to suggest references that supply more information. Chapters 2 and 3 of the book cover a range of topics that received dedicated attention during the “Startup Period” although some of the results were not incorporated into the structure of the standard model. Chapters 4-6 constitute the core of the book and try to recapture much of the conceptual excitement of the “Heroic Period”, when quantum flavordynamics (QFD) and quantum chromodynamics (QCD) received their definitive formulation. [It should be emphasized that, throughout the book, logical coherence takes precedence over historical chronology (e.g. some of the precision tests of QFD are discussed in Chapter 6)]. Chapter 7 provides a fairly complete discussion of the chiral gauge anomalies in four dimensions with special application to the standard model (although the larger unification models are also considered). The remaining three chapters of the book (Chapters 7-10) cover concepts and principles that originated primarily during the “Period of Consolidation and Speculation” but, again, this is not a literal statement. Chapters 8 and 9 report on two of the main directions that were pursued to overcome acknowledged deficiencies of the standard model: unification models in Chapter 8 and attempts to account for the existence of precisely three generations of quarks and leptons, primarily by means of preon models, in Chapter 9. The most innovative of the final three chapters of the book is Chapter 10 on topological conservation laws. This last chapter tries to explain the significance of topologically non-trivial solutions in four-dimensional (space-time) particle physics (e.g. 't Hooft-Polyakov monopoles, instantons, sphalerons, global SU(2) anomaly, Wess-Zumino term, etc.) and to reflect on some of the problems that have ensued (e.g. the “strong CP problem” in QCD) from this effort. It turns out that the more felicitous topological applications of field theory are found — as of now — in condensed matter physics; these successful physical applications (to polyacetylene, quantized magnetic flux in type-II low temperature superconductivity, etc.) are discussed in Chapter 10, as a good illustration of the conceptual unity of modern physics. Request Inspection Copy

An Introduction To The Standard Model Of Particle Physics For The Non-specialist - Marsh Gerald E 2017-10-06

This book takes the reader from some elementary ideas about groups to the essence of the Standard Model of particle physics along a relatively straight and intuitive path. Groups alone are first used to arrive at a classical analog of the Dirac equation. Using elementary quantum mechanics, this analog can be turned into the actual Dirac equation, which governs the motion of the quarks and leptons of the Standard Model. After an introduction to the gauge principle, the groups introduced in the beginning of the book are used to give an introduction to the Standard Model. The idea is to give an Olympian view of this evolution, one that is often missing when absorbing the detailed subject matter of the Standard Model as presented in an historical approach to the subject. Contents: PrefaceGroupsA Semblance of the Dirac Equation From GroupsMinimalist Quantum MechanicsGauge PrincipleStandard Model BeginningsParticles of the Standard Model and QCDAppendix A: The Particle EnigmaAppendix B: Spinor Representations of the Lorentz GroupAppendix C: The Schwinger TermAppendix D: The Cosmic Microwave Background RadiationA Few Reference BooksIndex Readership: Undergraduate students and academics interested in the Standard Model. Keywords: Standard Model Particle Physics;Standard Model QCDReview: Key Features: Presents the Standard Model not only using an historical approach, but also with some philosophical aspects, discussing some recent research on the nature of a "particle"

Perspectives on Particle Physics - S Matsuda 1989-03-01

This book is dedicated to Prof H Miyazawa in commemoration of his 60th birthday. He is an outstanding particle physicist who gave an original idea on nuclear magnetic moments and has led the frontier of particle physics. Here is a historical survey featuring the stress on phenomenologies in particle physics. It should be of interest to experimental physicists also. Contents:H Miyazawa, My Personal Memories and in the History of Sciences (H Morinaga)Phenomenological Theories of the Electromagnetic Structure of Nuclear Matter (R G Sachs)The Nucleons and Mesons (Y Hara)Superconvergent Propagators (R Oehme)Global Gauge Anomaly of Classical Groups in Even Dimension (S Okubo & H Zhang)Brief Review of the New Local Supersymmetry in the Vierbein Formalism of Einstein Gravity (N Nakanishi)and other papers Readership: Particle/high energy physicists and graduate students.

Introduction to Gauge Field Theories - M. Chaichian 2012-12-06

In recent years, gauge fields have attracted much attention in elementary par ticle physics. The reason is that great progress has been achieved in solving a number of important problems of field theory and elementary particle physics by means of the quantum theory of gauge fields. This refers, in particular, to constructing unified gauge models and theory of strong interactions between the elementary particles. This book expounds the fundamentals of the quantum theory of gauge fields and its application for constructing unified gauge models and the theory of strong interactions. In writing the book, the authors' aim was three-fold: firstly, to outline the basic ideas underlying the unified gauge models and the theory of strong inter actions; secondly, to discuss the major unified gauge models, the theory of strong interactions and their experimental implications; and, thirdly, to acquaint the reader with a rather special mathematical approach (path-in tegral method) which has proved to be well suited for constructing the quantum theory of gauge fields. Gauge fields are a vigorously developing area. In this book, we have select ed for presentation the more or less traditional and commonly accepted mate rial. There also exist a number of different approaches which are presently being developed. The most important of them are touched upon in the Conclusion.

Quarks, Leptons and Gauge Fields - Kerson Huang 1992-10-28

This is perhaps the most up-to-date book on Modern Elementary Particle Physics. The main content is an introduction to Yang-Mills fields, and the Standard Model of Particle Physics. A concise introduction to quarks is provided, with a discussion of the representations of SU(3). The Standard Model is presented in detail, including such topics as the Kobayashi-Maskawa matrix, chiral symmetry breaking, and the θ-vacuum. Theoretical topics of a more general nature include path integrals, topological solitons, renormalization group, effective potentials, the axial anomaly, and lattice gauge theory. This second edition, which has been expanded, incorporates the following new subjects: Wilson's renormalization scheme, and its relation to perturbative renormalization; pitfalls in quantizing gauge fields, such as the Gribov ambiguity; the lattice as a consistent regularization; Monte Carlo methods of solution; and the issues, folklores, and scenarios of quark confinement. More than a quarter of the book comprise of new materials. This book may be used as a text for a one-semester course on advanced quantum field theory, or reference book for particle physicists.

Quarks, Leptons, and Their Constituents - Antonino Zichichi 2012-12-06
From 5 to 15 August 1984, a group of 79 physicists from 61 laboratories in 26 countries met in Erice for the 22nd Course of the International School of Subnuclear Physics. The countries represented were Austria, Belgium, Brazil, Bulgaria, Canada, People's Republic of China, Denmark, the Federal Republic of Germany, France, Greece, Hungary, Iran, Israel, Italy, Japan, Korea, Malaysia, Mexico, the Netherlands, Pakistan, Poland, Sweden, Switzerland, Turkey, the United Kingdom, the United States of America. The School was sponsored by the Italian Ministry of Public Education (MPI), the Italian Ministry of Scientific and Technologi cal Research (MRST), the Regional Sicilian Government (ERS), and the Weizmann Institute of Science. The programme of the School was devoted to a review of the most significant results in theoretical and experimental research work on the interactions between what we believe today are the point like constituents of the world: quarks and leptons. It should however not be forgotten that many problems are still to be understood: especially in the forefront of the correla tion between quarks and leptons. This game started in 1966 with the proposal for "leptonic quarks" and went on with "preons" and "rishons" just to quote the most famous attempts to unify these two worlds.
Gauge Theories in Particle Physics, Third Edition - 2 volume set - Ian J.R. Aitchison 2004-01-01
This two-volume set provides an accessible, practical, and comprehensive introduction to the three gauge theories of the standard model of particle physics: quantum electrodynamics (QED), quantum chromodynamics (QCD), and the electroweak theory. For each of them, the authors provide a thorough discussion of the main conceptual points, a detailed exposition of many practical calculations of physical quantities, and a comparison of these quantitative predictions with experimental results. For this third edition, much has been rewritten to reflect developments over the last decade, both in the curricula of university courses and in particle physics research. On the one hand, substantial new material has been introduced that is intended for use in undergraduate physics courses. New introductory chapters provide a precise historical account of the properties of quarks and leptons and a qualitative overview of the quantum field description of their interactions, at a level appropriate to third year courses. The chapter on relativistic quantum mechanics has been enlarged and is supplemented by additional sections on scattering theory and Green functions, in a form appropriate to fourth-year courses. On the other hand, since precision experiments now test the theories beyond lowest order in perturbation theory, an understanding of the data requires a more sophisticated knowledge of quantum field theory, including ideas of renormalization. The treatment of quantum field theory has therefore been considerably extended to provide a uniquely accessible and self-contained introduction to quantum field dynamics as described by Feynman graphs. The level is suitable for advanced fourth-year undergraduates and first-year graduates. These developments are all contained in the first volume, which ends with a discussion of higher order corrections in QED. The second volume is devoted to the non-Abelian gauge theories of QCD and the electroweak theory. As in the first two editions, emphasis is placed throughout on developing realistic calculations from a secure physical and conceptual basis.
Gauge Field Theories - J. Leite Lopes 2013-09-03
Gauge Field Theories: An Introduction covers the basic notions and principles of gauge theories. This book is composed of 10 chapters that focus on the Salam-Weinberg model of electro-weak interactions of neutrino-lepton scattering, as well as the Parton model. The first chapter is an introduction to solitons and instantons, as well as the topological quantum numbers, subjects that arose from the study of the non-linear field equations in gauge theories. The succeeding chapters deal with the concept of gravitational field, electrodynamical systems, the Yang-mills gauge fields, and the Higgs mechanism. The remaining chapters highlight the speculations on possible lepton and quark structured. These chapters present the SU(5) model of grand unification. This book will prove useful to physics university and advanced high school students.
Gauge Theories in Particle Physics - I.J.R. Aitchison 2002-09-01
Gauge Theories in Particle Physics, Volume 1: From Relativistic Quantum Mechanics to QED, Third Edition presents an accessible, practical, and comprehensive introduction to the three gauge theories of the standard model of particle physics: quantum electrodynamics (QED), quantum chromodynamics (QCD), and the electroweak theory. For each of them, the authors provide a thorough discussion of the main conceptual points, a detailed exposition of many practical calculations of physical quantities, and a comparison of these quantitative predictions with experimental results. For this two-volume third edition, much of the book has been rewritten to reflect developments over the last decade, both in the curricula of university courses and in particle physics research. Substantial new material has been introduced that is intended for use in undergraduate physics courses. New introductory chapters provide a precise historical account of the properties of quarks and leptons, and a qualitative overview of the quantum field description of their interactions, at a level appropriate to third year courses. The chapter on relativistic quantum mechanics has been enlarged and is supplemented by additional sections on scattering theory and Green functions, in a form appropriate to fourth year courses. Since precision experiments now test the theories beyond lowest order in perturbation theory, an understanding of the data requires a more sophisticated knowledge of quantum field theory, including ideas of renormalization. The treatment of quantum field theory has therefore been considerably extended so as to provide a uniquely accessible and self-contained introduction to quantum field dynamics, as described by Feynman graphs. The level is suitable for advanced fourth year undergraduates and first year graduates. These developments are all contained in the first volume, which ends with a discussion of higher order corrections in QED; the second volume is devoted to the non-Abelian gauge theories of QCD and the electroweak theory. As in the first two editions, emphasis is placed throughout on developing realistic calculations from a secure physical and conceptual basis.
Quarks: Frontiers In Elementary Particle Physics - Yoichiro Nambu 1985-05-01
The book explains in a precise and complete manner how elementary particle physics has evolved over the past 50 years. The historical development of the ideas that have shaped our thinking about the ultimate constituents of matter is traced out. The author has been associated with some of the originators of elementary particle theory and has made significant contributions to the field. Here, he gives a first-person description of some of the main developments leading to our present view of the universe.
Energy Research Abstracts - 1987

Collider Physics Within the Standard Model - Guido Altarelli 2020-10-08
With this graduate-level primer, the principles of the standard model of particle physics receive a particular skillful, personal and enduring exposition by one of the great contributors to the field.In 2013 the late Prof. Altarelli wrote: The discovery of the Higgs boson and the non-observation of new particles or exotic phenomena have made a big step towards completing the experimental confirmation of the standard model of fundamental particle interactions. It is thus a good moment for me to collect, update and improve my graduate lecture notes on quantum chromodynamics and the theory of electroweak interactions, with main focus on collider physics. I hope that these lectures can provide an introduction to the subject for the interested reader, assumed to be already familiar with quantum field theory and some basic facts in elementary particle physics as taught in undergraduate courses. This work was published by Saint Philip Street Press pursuant to a Creative Commons license permitting commercial use. All rights not granted by the work's license are retained by the author or authors.
Beyond the Nanoworld - H. G. Dosch 2008-01-11
Beyond the world of atoms, at scales smaller than the smallest nuclei, a new world comes into view, populated by an array of colorful elementary particles: strange and charmed quarks, muons and neutrinos, gluons and photons, and many others, all interacting in beautifully intricate patterns. Beyond the Nanoworld tells the story of how this new real
Particle Physics - Brian R. Martin 2013-03-22
An essential introduction to particle physics, with coverage ranging from the basics through to the very latest developments, in an accessible and carefully structured text. Particle Physics: Third Edition is a revision of a highly regarded introduction to particle physics. In its two previous editions this book has proved to be an accessible and balanced introduction to modern particle physics, suitable for those students needed a more comprehensive introduction to the subject than provided by the ‘compendium’ style physics books. In the Third Edition the standard model of particle physics is carefully developed whilst unnecessary mathematical formalism is avoided where possible. Emphasis is placed on the interpretation of experimental data in terms of the basic properties of quarks and leptons. One of the major developments of the past decade has been the establishing of the existence of neutrino oscillations. This will have a profound effect on the plans of

experimentalists. This latest edition brings the text fully up-to-date, and includes new sections on neutrino physics, as well as expanded coverage of detectors, such as the LHC detector. End of chapter problems with a full set of hints for their solutions provided at the end of the book. An accessible and carefully structured introduction to this demanding subject. Includes more advanced material in optional ‘starred’ sections. Coverage of the foundations of the subject, as well as the very latest developments.

Fundamental Forces of Nature - Kerson Huang 2007

What makes the world tick? -- Electromagnetism -- The vacuum is the medium -- Let there be light -- Heroic age: the struggle for quantum theory -- Quantum reality -- What is charge? -- The zen of rotation -- Yang-Mills field: non-commuting charges -- Photons real and virtual -- Creation and annihilation -- The dynamical vacuum -- Elementary particles -- The fall of parity -- The particle explosion -- Quarks -- All interactions are local -- Broken symmetry -- Quark confinement -- Hanging threads of silk -- The world in a grain of sand -- In the space of all possible theories -- Epilogue: beauty is truth.

Leptons and Quarks - L.B. Okun 2013-05-10

This book comprises an introduction to the theory of the weak interaction of elementary particles. The author outlines the current situation in weak interaction theory and discusses the prospects for the coming decade. The reader is familiarized with simple theoretical techniques for the calculation of decay rates, interaction cross-sections and angular and spin correlations.

QUARK & LEPTONS: AN INTRODUCTORY COURSE IN MODERN PARTICLE PHYSICS - Francis Halzen 2008-05-17

· A Preview of Particle Physics· Symmetries and Quarks· Antiparticles· Electrodynamics of Spinless Particles· The Dirac Equation· Electrodynamics of Spin-1/2 Particles· Loops, Renormalization, Running Coupling Constants, and All That· The Structure of Hadrons· Partons· Quantum Chromodynamics· Annihilation and QCD· Weak Interactions· Electroweak Interactions· Gauge Symmetries· The Weinberg-Salam Model and Beyond

Elementary Particles and Their Interactions - Stephen P. Martin 2022-10-26

The Standard Model of elementary particle physics was tentatively outlined in the early 1970s. The concepts of quarks, leptons, neutrinos, gauge symmetries, chiral interactions, Higgs boson, strong force, weak force, and electromagnetism were all put together to form a unifying theory of elementary particles. Furthermore, the model was developed within the context of relativistic quantum field theory, making it compatible with all of the laws of Einstein's Special Relativity. The successes of the Standard Model over the years have been tremendous and enduring, leading up to the recent discovery and continuing study of the Higgs boson. This book is a comprehensive and technical introduction to Standard Model physics. Martin and Wells provide readers who have no prior knowledge of quantum field theory or particle physics a firm foundation into the fundamentals of both. The emphasis is on obtaining practical knowledge of how to calculate cross-sections and decay rates. There is no better way to understand the necessary abstract knowledge and solidify its meaning than to learn how to apply it to the computation of observables that can be measured in a laboratory. Beginning graduate students, both experimental and theoretical, and advanced undergraduate students interested in particle physics, will find this to be an ideal one-semester textbook to begin their technical learning of elementary particle physics.

Quarks, Leptons & Gauge Fields - Kerson Huang 1992

This is perhaps the most up-to-date book on Modern Elementary Particle Physics. The main content is an introduction to Yang-Mills fields, and the Standard Model of Particle Physics. A concise introduction to quarks is provided, with a discussion of the representations of SU(3).The Standard Model is presented in detail, including such topics as the Kobayashi-Maskawa matrix, chiral symmetry breaking, and the ?-vacuum. Theoretical topics of a more general nature include path integrals, topological solitons, renormalization group, effective potentials, the axial anomaly, and lattice gauge theory.This second edition, which has been expanded, incorporates the following new subjects: Wilson's renormalization scheme, and its relation to perturbative renormalization; pitfalls in quantizing gauge fields, such as the Gribov ambiguity; the lattice as a consistent regularization; Monte Carlo methods of solution; and the issues, folklores, and scenarios of quark confinement. More than a quarter of the book comprise of new materials.This book may be used as a text for a one-semester course on advanced quantum field theory, or reference book for particle physicists.

Weak Interactions of Leptons and Quarks - Eugene D. Commins 1983-07-29

In recent years, the study of weak interaction and its relationship with the other fundamnetal interactions of nature has progressed rapidly. Weak interactions of leptons and quarks provides an up-to-date account of this continuing research. The Introduction discusses early models and historical developments in the understanding of the weak force. The authors then give a clear presentation of the modern theoretical basis of weak interactions, going on to discuss recent advances in the field. These include development of the eletroweak gauge theory, and the discovery of neutral currents and of a host of new particles. There is also a chapter devoted entirely to neutrino astrophysics. Its straightforward style and its emphasis on experimental results will make this book an excellent source for students (problem sets are included at the end of each chapter) and experimentalists in the field. Physicists whose speciality lies outside the study of elementary particle physics will also find it useful.

An Introduction To Quantum Field Theory, Student Economy Edition - Michael Peskin 2018-04-27

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.

From Photons to Higgs - Moo-Young Han 2014-02-20

This book presents a brief introduction to the quantum field theory of the Standard Model for quarks and leptons. With minimal use of mathematics, it covers the basics of quantum field theory, local gauge field theory, spontaneous symmetry breaking mechanism, the Higgs mechanism and quantum chromodynamics. From the time when the first edition was published until today, the field of particle physics has seen some major break-through with the possible discovery of Higgs particle, also known as the Higgs boson. In the second edition, the famous Higgs mechanism is included to explain the symmetry breaking in the Standard Model and the origin of mass, and all of this is explained in high-school level algebra. Aimed at both scientists and non-specialists, it requires only some rudimentary knowledge of the Lagrangian and Hamiltonian formulation of Newtonian mechanics as well as a basic understanding of the special theory of relativity and quantum mechanics to enjoy this book. Contents:Particles and Fields I: DichotomyLagrangian and Hamiltonian DynamicsCanonical QuantizationParticles and Fields II: DualityEquations for DualityElectromagnetic FieldEmulation of Light I: Matter FieldsRoad Map for Field QuantizationParticles and Fields III: Particles as Quanta of FieldsEmulation of Light II: InteractionsTriumph and WaneLeptons and QuarksWhat is Gauge Field Theory?The Weak Gauge FieldsThe Higgs Mechanism and the Electroweak Gauge FieldsThe Higgs ParticleEvolution of the Strong ForceThe History of Color SU(3) SymmetryQuantum Chromodynamics, QCDAppendices:The Natural Unit SystemNotationVelocity-Dependent PotentialFourier Decomposition of FieldMass Units for ParticlesMass-Range Relation Readership: Students, researchers, academics and non-specialists interested in quantum field theory. Keywords:Quarks;Leptons;Gluons;Color Charges;Standard Model;Higgs Particle;Quantum Chromodynamics;Spontaneous Symmetry Breaking