An Invitation to Quantum Field Theory

This book provides an introduction to Quantum Field Theory (QFT) at an elementary level—with only special relativity, electromagnetism and quantum mechanics as prerequisites. For this fresh approach to teaching QFT, based on numerous lectures and courses given by the authors, a representative sample of topics has been selected containing some of the more innovative, challenging or subtle concepts. They are presented with a minimum of technical details, the discussion of the main ideas being more important than the presentation of the typically very technical mathematical details necessary to obtain the final results.

Contents

Fields of interest
Elementary Particles, Quantum Field Theory; Quantum Field Theories, String Theory; Quantum Physics

Target groups
Research

Available
2012. XI, 294 p. 91 illus. (Lecture Notes in Physics, Volume 839) Softcover
► $59.95
ISBN 978-3-642-23727-0

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Handbook of Theoretical Atomic Physics

Data for Photon Absorption, Electron Scattering, and Vacancies Decay

The aim of this book is to present highly accurate and extensive theoretical Atomic data and to give a survey of selected calculational methods for atomic physics, used to obtain these data.

Features
► Presents a rich set of data for atomic physics, chemistry, material science, astrophysics ► Gives an overview of selected calculational methods for atomic physics ► Contains extensive descriptions of physical processes presented with rich illustrations ► Provides a basis for planning experiments in atomic and molecular physics

Contents

Fields of interest
Atomic, Molecular, Optical and Plasma Physics; Optics, Optoelectronics, Plasmonics and Optical Devices; Physical Chemistry

Target groups
Research

Available
Additional material, figures and some tables, will be presented on the Springer webpage as supplement to the book

2012. 550 p. 420 illus., 120 in color. Hardcover
► approx. $409.00
ISBN 978-3-642-24751-4

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Non-Centrosymmetric Superconductors

Introduction and Overview

Superconductivity in materials without inversion symmetry in the respective crystal structures occurs in the presence of antisymmetric spin-orbit coupling as a consequence of an emerging electric field gradient. The superconducting condensate is then a superposition of spin-singlet and spin-triplet Cooper pairs. This scenario accounts for various experimental findings such as nodes in the superconducting gap or extremely large upper critical magnetic fields.

Features
► Provides the first comprehensive introduction and overview of this emerging field ► Authored and edited by leading researchers in the field ► Suitable for self-study and advanced courses and seminars

Contents

Fields of interest
Strongly Correlated Systems, Superconductivity; Surface and Interface Science, Thin Films; Solid State Physics

Target groups
Research

Available
2012. VII, 354 p. 151 illus. (Lecture Notes in Physics, Volume 847) Softcover
► $89.95
ISBN 978-3-642-24623-4
Stardust, Supernovae and the Molecules of Life
Might We All Be Aliens?

Contents

Fields of interest
Astrobiology; Popular Science in Astronomy; Evolutionary Biology

Target groups
Popular/general

Discount group
P

Particles and Fundamental Interactions
An Introduction to Particle Physics

Features
► Based on the lectures of Giorgio M. Giacomelli, one of the most influential experimentalists in particle physics in the last 40 years ► A comprehensive text that covers both traditional and recent topics in particle physics ► Provides the theoretical and phenomenological basis to understand the subatomic structure of matter

Contents

Fields of interest
Astrobiology; Popular Science in Astronomy; Evolutionary Biology

Target groups
Popular/general

Discount group
P

Due January 2012

2012. XX, 230 p. 40 illus., 27 in color. (Astronomers’ Universe) Softcover
► approx. $29.95
ISBN 978-1-4614-1331-8

S. Braibant, G. Giacomelli, M. Spurio, University of Bologna, Italy

Modern Theories of Many-Particle Systems in Condensed Matter Physics

Condensed matter systems where interactions are strong are inherently difficult to analyze theoretically. The situation is particularly interesting in low-dimensional systems, where quantum fluctuations play a crucial role. Here, the development of non-perturbative methods and the study of integrable field theory have facilitated the understanding of the behavior of many quasi-one- and two-dimensional strongly correlated systems.

Features
► Bridges the gap between standard textbook material and the frontier of science ► Edited and authored by leading scientists in the field ► Written in tutorial style

Contents

Fields of interest
Strongly Correlated Systems, Superconductivity; Statistical Physics, Dynamical Systems and Complexity; Magnetism, Magnetic Materials

Target groups
Research

Discount group
P

Available

Original title: Particelle e interazioni fondamentali
2nd ed. 2012. XIV, 486 p. 196 illus., 35 in color. (Undergraduate Lecture Notes in Physics) Hardcover
► $89.95
ISBN 978-94-007-2463-1

Available

2012. XIII, 368 p. 130 illus. (Lecture Notes in Physics, Volume 843) Softcover
► $89.95
ISBN 978-3-642-10448-0
Quantum Triangulations
Moduli Spaces, Strings, and Quantum Computing

Research on polyhedral manifolds often points to unexpected connections between very distinct aspects of Mathematics and Physics. In particular, triangulated manifolds play a distinguished role in such settings as Riemann moduli space theory, strings and quantum gravity, topological quantum field theory, condensed matter physics, and critical phenomena. Not only do they provide a natural discrete analogue to the smooth manifolds on which physical theories are typically formulated, but their appearance is rather often a consequence of an underlying structure which naturally calls into play non-trivial aspects of representation theory, of complex analysis and topology in a way which makes manifest the basic geometric structures of the physical interactions involved.

Features
- Authored by leading experts in the field
- First self-contained exposition of the subject matter
- Suitable for graduate students and specialists alike

Contents

Fields of interest
Physics, general; Mathematical Physics; Quantum Physics

Target groups
Research

Discount group
P

Quantum Entanglement in Electron Optics
Generation, Characterization, and Applications

This monograph forms an interdisciplinary study in atomic, molecular, and quantum information (QI) science. Here a reader will find that applications of the tools developed in QI provide new physical insights into electron optics as well as properties of atoms and molecules which, in turn, are useful in studying QI both at fundamental and applied levels. In particular, this book investigates entanglement properties of flying electronic qubits generated in some of the well known processes capable of taking place in an atom or a molecule following the absorption of a photon. Here, one can generate Coulombic or fine-structure entanglement of electronic qubits.

Features
- Provides a first multi-disciplinary study combining atomic and molecular physics with quantum information
- Considers quantum entanglement in electron optics
- Contains a generic computer programme needed for calculating density matrices suitable for studying electron optics using tools from quantum information

Contents

Fields of interest
Atomic, Molecular, Optical and Plasma Physics; Mathematical Methods in Physics; Quantum Physics

Target groups
Research

Discount group
P

From the Universe to the Elementary Particles
A First Introduction to Cosmology and the Fundamental Interactions

In this book, the author leads the reader, step by step and without any advanced mathematics, to a clear understanding of the foundations of modern elementary particle physics and cosmology. He also addresses current and controversial questions on topics such as string theory. The book contains gentle introductions to the theories of special and general relativity, and also classical and quantum field theory. The essential aspects of these concepts are understood with the help of simple calculations; for example, the force of gravity as a consequence of the curvature of the space-time.

Features
- Ideal for students, newcomers to the field and teachers
- Easily comprehensible presentation of the biggest riddles in physics
- Only intermediate mathematics (elementary calculus) required
- Problems and worked examples aid understanding

Contents

Fields of interest
Astronomy, Astrophysics and Cosmology; Particle and Nuclear Physics; Classical and Quantum Gravitation, Relativity Theory

Target groups
Lower undergraduate

Discount group
P
M. Frémond, Università di Roma „Tor Vergata“, Italy

Phase Change in Mechanics

Predictive theories of phenomena involving phase change with applications in engineering are investigated in this volume, e.g. solid-liquid phase change, volume and surface damage, and phase change involving temperature discontinuities. Many other phase change phenomena such as solid-solid phase change in shape memory alloys and vapor-liquid phase change are also explored. Modeling is based on continuum thermo-mechanics.

Contents

Fields of interest
Phase Transitions and Multiphase Systems; Mathematical Modeling and Industrial Mathematics; Continuum Mechanics and Mechanics of Materials

Target groups
Research

Discount group
P

W. Gonzalez, INPE, São José dos Campos, Brazil; J. L. Burch, Southwest Research Institute, San Antonio, TX, USA (Eds)

Key Processes in Solar-Terrestrial Physics

“Key processes in Solar-Terrestrial Physics” deals with a nice selection of key phenomena concerning Solar-Terrestrial relations. During the week of October 4–9, 2009, about 160 participants from 19 countries met at the Itamambuca resort area of Ubatuba, Sao Paulo, Brazil to discuss the influence of solar variability on geophysical and heliospheric phenomena at a conference organized by the International Living With a Star (ILWS) Program of NASA and by the National Institute of Space Research (INPE) of Brazil. Five of the invited review talks of this Conference are being published in this special issue, plus one (on magnetospheric reconnection) especially invited to cover a missing important subject within the Solar-Terrestrial physics domain.

Contents

Fields of interest
Astronomy, Observations and Techniques; Extra-terrestrial Physics, Space Sciences

Target groups
Research

Discount group
P

M. Greiter, Karlsruhe Institut für Technologie KIT, Germany

Mapping of Parent Hamiltonians

From Abelian and non-Abelian Quantum Hall States to Exact Models of Critical Spin Chains

This monograph introduces an exact model for a critical spin chain with arbitrary spin S, which includes the Haldane–Shastry model as the special case S=1/2. While spinons in the Haldane-Shastry model obey abelian half-fermi statistics, the spinons in the general model introduced here obey non-abelian statistics. This manifests itself through topological choices for the fractional momentum spacings. The general model is derived by mapping exact models of quantized Hall states onto spin chains. The book begins with pedagogical review talks of this Conference are being published in this special issue, plus one (on magnetospheric reconnection) especially invited to cover a missing important subject within the Solar-Terrestrial physics domain.

Fields of interest
Condensed Matter Physics; Quantum Physics; Statistical Physics, Dynamical Systems and Complexity

Target groups
Research

Discount group
P

Available
2012. X, 292 p. 66 illus., 36 in color. (Lecture Notes of the Unione Matematica Italiana, Volume 13) Softcover
► $89.95
ISBN 978-3-642-24608-8

Due October 2011
2012. CLXVI, 6 p. 90 illus., 48 in color. Hardcover
► $129.00
ISBN 978-1-4614-1492-6

Available
2012. XI, 196 p. 12 illus. (Springer Tracts in Modern Physics, Volume 244) Hardcover
► $159.00
ISBN 978-3-642-24383-1
Landolt-Börnstein: Numerical Data and Functional Relationships in Science and Technology - New Series

Editor-in-chief: W. Martienssen

Molecules and Radicals

Subvolume 29A1

W. Hüttnern, Universität Ulm, Germany
W. Hüttnern, Universität Ulm, Germany (Ed.)

Diatomic Molecules 1

Molecular Constants Mostly from Microwave, Molecular Beam and Sub-Doppler Laser Spectroscopy, Subvol. A, part 1

Volume II/29 „Molecular Constants Mostly from Microwave, Molecular Beam, and Sub-Doppler Laser Spectroscopy” is planned to appear as a series A1, A2, B, C and D1, D2, D3 for the diamagnetic, and E for the paramagnetic linear and polyatomic species, respectively. Like in the preceding volumes II/24 and II/19, which have appeared in the years around 1999 and 1992, respectively, the diamagnetic substances are arranged in the manner suggested by Hill („Hill’s system“, 1900), meaning an almost strict alphabetical order. The ionic species are included in the alphabetical arrangement of the neutral ones in each table.

Features

► Standard reference book with selected and easily retrievable data from the fields of physics and chemistry collected by acknowledged international scientists ► Also available online on www.SpringerMaterials.com

Fields of interest

Physics, general; Atomic/Molecular Structure and Spectra

Target groups

Research

Discount group

L

Landolt-Börnstein: Numerical Data and Functional Relationships in Science and Technology - New Series

Editor-in-chief: W. Martienssen

Molecules and Radicals

Subvolume 29B

G. Wlodarczak, Universite Sciences et Technique, Villeneuve-D'Ascq, France
W. Hüttnern, Universität Ulm, Germany (Ed.)

Linear Molecules

Molecular Constants Mostly from Microwave, Molecular Beam and Sub-Doppler Laser Spectroscopy, Subvol. B

Volume II/29 „Molecular Constants Mostly from Microwave, Molecular Beam, and Sub-Doppler Laser Spectroscopy” is planned to appear as a series A, B, C and D1, D2, D3 for the diamagnetic, and E for the paramagnetic linear and polyatomic species, respectively. Like in the preceding volumes II/24 and II/19, which have appeared in the years around 1999 and 1992, respectively, the diamagnetic substances are arranged in the manner suggested by Hill („Hill’s system“, 1900), meaning an almost strict alphabetical order. The ionic species are included in the alphabetical arrangement of the neutral ones in each table.

Features

► Standard reference book with selected and easily retrievable data from the fields of physics and chemistry collected by acknowledged international scientists ► Also available online

Fields of interest

Physics, general; Atomic/Molecular Structure and Spectra

Target groups

Research

Discount group

L

Available

2012. 500 p. / Molecules and Radicals, Subvolume 29B) Hardcover
► approx. $6199.00
ISBN 978-3-540-60329-9
Landolt-Börnstein: Numerical Data and Functional Relationships in Science and Technology - New Series

Editor-in-chief: W. Martienssen

Physical Chemistry Subvolume 26B

I. Cibulka, Institute of Chemical Technology, Prague, Czech Republic; J.-C. Fontaine, ITODYS-CNRS, Paris, France; H. V. Kehiaian, K. Sosnkowska-Kehiaian, ITODYS-CNRS, Paris, France

Binary Liquid Systems of Nonelectrolytes II

Vapor-liquid equilibrium data, heat of mixing (excess enthalpies), and volumetric properties of systems are required for both the applications in design of industrial technological processes and the understanding the structure and the intermolecular interactions in the systems. On the basis of classical thermodynamics the measured experimental data combined together enable us the calculation of non-measurable thermodynamic properties significant for the technological calculations. The present volume is a compilation of experimental and derived property data on subcritical binary homogeneous (single-phase) or heterogeneous (two-phase) liquid–liquid mixtures.

Features

► Standard reference book with selected and easily retrievable data from the fields of physics and chemistry collected by acknowledged international scientists ► Also available online on www.springermaterials.com

Available
2012. 611 p. / Physical Chemistry, Subvolume 26B) Hardcover ► approx. $6199.00 ISBN 978-3-642-23276-3

Nanomedicine and Nanobiotechnology

This book presents the laboratory, scientific and clinical aspects of nanomaterials used for medical applications in the fields of regenerative medicine, dentistry and pharmacy. It gives a broad overview on the in vitro compatibility assessment of nanostructured materials implemented in the medical field by the combination of classical biological protocols and advanced non-destructive nano-precision techniques with special emphasis on the topographical, surface energy, optical and electrical properties. Materials in the physical form of nanoparticles, nanotubes, and thin films are addressed in terms of their toxicity.

Features

► Presents recent advances in nanomedicine and nanobiology ► Reviews biomedical applications of nanomaterials ► Shows a broad spectrum of interdisciplinary approaches of medicine, biology, pharmacy, physics, chemistry, engineering, and materials science

Contents

Nanotechnology and medical applications.- Nanomedicine pillars and monitoring nano-bio interactions.- In-vitro testing of thin films.- Biofunctionalization of surfaces with peptides, proteins or sub cellular organelles: single molecule studies and nanomedical approach.- Imaging the human body: micro- and nanostructure of human tissues.- Nanodentistry.- Immune toxicity of nanomedicines.- Imaging of the brain with nanoparticles.- Pharmacogenomics and nanotechnology towards advancing personalized medicine.

Fields of interest

Nanoscale Science and Technology; Biophysics and Biological Physics; Biomaterials

Available

Matter, Dark Matter, and Anti-Matter

In Search of the Hidden Universe

For over ten years, the dark side of the universe has been headline news. Detailed studies of the rotation of spiral galaxies, and ‘mirages’ created by clusters of galaxies bending the light from very remote objects, have convinced astronomers of the presence of large quantities of dark (unseen) matter in the cosmos. The most striking fact is that they seem to compromise about 95% of the matter/energy content of the universe.

Features

► Presents the nature of “ordinary matter” in the universe and how it developed from the first three seconds to the present universe ► Includes the latest information on current astrophysical research concerning hidden or dark baryons ► Demonstrates how cosmologists aim to uncover the nature of “hidden” baryons

Contents

Foreword.- Author’s preface.- Acknowledgments.- List of illustrations.- Chapter 1: Introduction.- Chapter 2: Matter concentrated.- Chapter 3: The realm of the nebulae.- Chapter 4: Getting warmer....- Chapter 5: Cosmic Cluedo: where, when, and how?.- Chapter 6: 300,000 years on: all present and correct.- Chapter 7: Cosmic canvas.- Chapter 8: Lifting the veil: simulations.- Chapter 9: A constant search.- Chapter 10: From telescopes to accelerators.- Appendices.

Fields of interest

Astronomy, Astrophysics and Cosmology; Particle and Nuclear Physics

Available

Due November 2011


S. Logothetidis, Aristotle University of Thessaloniki, Greece (Ed.)

A. Mazure, V. Le Brun, Marseille, France
H. Paetz gen. Schieck, Universität Köln, Germany

**Nuclear Physics with Polarized Particles**

The measurement of spin-polarization observables in reactions of nuclei and particles is of great utility and advantage when the effects of single-spin sub-states are to be investigated. Indeed, the unpolarized differential cross-section encompasses the averaging over the spin states of the particles, and thus loses details of the interaction process. This introductory text combines, in a single volume, course-based lecture notes on spin physics and on polarized-ion sources with the aim of providing a concise yet self-contained starting point for newcomers to the field, as well as for lecturers in search of suitable material for their courses and seminars.

**Features**
- Tutorial and self-contained, course-based text at graduate level
- Treats both theory and experiment
- Written by leading expert in the field

**Contents**

**Fields of interest**
Nuclear Physics, Heavy Ions, Hadrons; Measurement Science and Instrumentation; Quantum Physics

**Target groups**
Research

**Discount group**
P

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A. Patane, The University of Nottingham, UK; N. Balkan, University of Essex, UK (Eds)

**Semiconductor Research**

**Experimental Techniques**

The book describes the fundamentals, latest developments and use of key experimental techniques for semiconductor research. It explains the application potential of various analytical methods and discusses the opportunities to apply particular analytical techniques to study novel semiconduc-
tor compounds, such as dilute nitride alloys. The emphasis is on the technique rather than on the particular system studied.

**Features**
- Describes the fundamentals of key experimental techniques for research on semiconduc-
tors
- Displays novel II-V semiconductor materials and graphene
- Describes the latest development of several experimental techniques in semiconductor research
- Provides examples of how these techniques can be used to study novel materials
- Richly illustrated with sketches of set-ups and experiments, images of samples and devices
- Contains many experimental data

**Contents**

**Fields of interest**
Semiconductors; Spectroscopy and Microscopy; Optical and Electronic Materials

**Target groups**
Research

**Discount group**
P

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T. Plehn, University of Heidelberg, Germany

**Lectures on LHC Physics**

When trying to apply the solid knowledge of quantum field theory to actual LHC physics - in particular to the Higgs sector and certain regimes of QCD - one inevitably meets an intricate maze of phenomenological know-how, common lores and other, often historically grown intuition about what works and what not. These lectures are intended to be a brief but sufficiently detailed primer on LHC physics that will enable graduate students and any newcomer to the field to find their way through the more advanced literature as well as helping them to start work in this very timely and exciting field of research.

**Features**
- Course tested, tutorial exposition
- Self-Containing, concise and suitable for self-study
- Provides detailed derivations

**Contents**
Higgs Physics.- QCD.- LHC Phenomenology.- Index.

**Fields of interest**
Elementary Particles, Quantum Field Theory; Quantum Field Theories, String Theory; Nuclear Physics, Heavy Ions, Hadrons

**Target groups**
Graduate

**Discount group**
P

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T. Yatsui, University of Tokyo, Japan

**Nanophotonic Fabrication**

**Self-Assembly and Deposition Techniques**

Nanophotonics, a novel optical technology, utilizes the local interaction between nanometric particles via optical near fields. The optical near fields are the elementary surface excitations on nanometric particles, i.e. dressed photons that carry material energy. Of the variety of qualitative innovations in optical technology realized by nanophotonics, this book focuses on fabrication. To fabricate nano-scale photonic devices with nanometer-scale controllability in size and position, we developed a self-assembly method for size- and position-controlled ultra-long nanodot chains using a novel effect of near-field optical desorption. A novel deposition and etching scheme under nonresonant conditions is also demonstrated and its origin is reviewed.

**Features**

- Introduces a novel effect of near-field optical desorption applied for fabrication of nanoscale photonic device
- Presents a novel deposition and etching scheme under nonresonant conditions
- Features a lot of examples and practical orientation
- Explains a self-assembly method for size- and position-controlled ultra-long nanodot chains
- Develops a novel deposition and etching scheme

**Contents**


**Fields of interest**

Optics, Optoelectronics, Plasmonics and Optical Devices; Nanoscale Science and Technology; Nanotechnology

**Target groups**

Research

**Discount group**

P

**Available**

2012. 200 p. 130 illus., 30 in color. (Nano-Optics and Nanophotonics) Hardcover

$129.00

ISBN 978-3-642-24171-0