

A. D. Bandrauk, Université de Sherbrooke, QC, Canada; M. Ivanov, Imperial College London, UK (Eds.)

Quantum Dynamic Imaging

Theoretical and Numerical Methods

Studying and using light or “photons” to image and then to control and transmit molecular information is among the most challenging and significant research fields to emerge in recent years. One of the fastest growing areas involves research in the temporal imaging of quantum phenomena, ranging from molecular dynamics in the femto (10^{*-15} s) time regime for atomic motion to the atto (10^{*-18} s) time scale of electron motion. In fact, the attosecond “revolution” is now recognized as one of the most important recent breakthroughs and innovations in the science of the 21st century. A major participant in the development of ultrafast femto and attosecond temporal imaging of molecular quantum phenomena has been theory and numerical simulation of the nonlinear, non-perturbative response of atoms and molecules to ultrashort laser pulses. Therefore, imaging quantum dynamics is a new frontier of science requiring advanced mathematical approaches for analyzing and solving spatial and temporal multidimensional partial differential equations such as Time-Dependent Schroedinger Equations (TDSE), Time-Dependent Dirac equations (TDDEs for relativistic phenomena), and which are also coupled to the photons in Maxwell’s equations for collective propagation effects.

Features

► Presents the latest research results in ultrafast imaging of quantum phenomena ► Demonstrates the wide-ranging potential of quantum dynamic imaging for R&D in areas as diverse as optoelectronics, materials science, and quantum information ► Edited and written by international leaders in the field

Fields of interest

Quantum Optics; Physical Chemistry; Optical and Electronic Materials

Target groups

Research

Discount group

P

R. Boudet, Université de Provence, Bassan, France

Quantum Mechanics in the Geometry of Space-Time

Elementary Theory

This book continues the fundamental work of Arnold Sommerfeld and David Hestenes formulating theoretical physics in terms of Minkowski space-time geometry. We see how the standard matrix version of the Dirac equation can be reformulated in terms of a real space-time algebra, thus revealing a geometric meaning for the “number i ” in quantum mechanics. Next, it is examined in some detail how electroweak theory can be integrated into the Dirac theory and this way interpreted in terms of space-time geometry. Finally, some implications for quantum electrodynamics are considered. The presentation of real quantum electromagnetism is expressed in an addendum. The book covers both the use of the complex and the real languages and allows the reader acquainted with the first language to make a step by step translation to the second one.

Features

► Represents the most complete treatment of relativistic quantum mechanics in terms of real spacetime algebra ► Demonstrates practical advantages of STA theory ► Shows how to incorporate electroweak theory and gives novel insight into calculation of the Lamb shift, one of the pivotal problems in relativistic quantum theory

Fields of interest

Mathematical Methods in Physics; Quantum Field Theories, String Theory; Classical and Quantum Gravitation, Relativity Theory

Target groups

Research

Discount group

P

G. G. Gladush, Troitsk Trinity, Moscow region, Russia; I. Smurov, ENISE, Saint-Etienne, France

Physics of Laser Materials Processing

Theory and Experiment

This book describes the basic mechanisms, theory, simulations and technological aspects of Laser processing techniques. It covers the principles of laser quenching, welding, cutting, alloying, selective sintering, ablation, etc. The main attention is paid to the quantitative description. The diversity and complexity of technological and physical processes is discussed using a unitary approach. The book aims on understanding the cause-and-effect relations in physical processes in Laser technologies. It will help researchers and engineers to improve the existing and develop new Laser machining techniques. The book addresses readers with a certain background in general physics and mathematical analysis: graduate students, researchers and engineers practicing laser applications.

Features

► Practical book for laser processing ► Explains theory and simulation as basics ► Strong in laser applications for welding, cutting, alloying, selective sintering, ablation ► Presents new laser machining techniques

Fields of interest

Laser Technology, Photonics; Applied and Technical Physics; Optics, Optoelectronics, Plasmonics and Optical Devices

Target groups

Graduate

Discount group

P

Due May 2011

2011. XVIII, 233 p. 79 illus., 76 in color. (CRM Series in Mathematical Physics) Hardcover

► approx. \$129.00

ISBN 978-1-4419-9490-5

Due May 2011

2011. 119 p. 20 illus. (SpringerBriefs in Physics) Softcover

► \$49.95

ISBN 978-3-642-19198-5

Due April 2011

2011. 490 p. 500 illus. (Springer Series in Materials Science, Volume 146) Hardcover

► approx. \$169.00

ISBN 978-3-642-19242-5

J. Harnad, CRM, Montreal CANADA (Ed.)

Random Matrices, Random Processes and Integrable Systems

This book explores the remarkable connections between two domains that, a priori, seem unrelated: Random matrices (together with associated random processes) and integrable systems. The relations between random matrix models and the theory of classical integrable systems have long been studied. These appear mainly in the deformation theory, when parameters characterizing the measures or the domain of localization of the eigenvalues are varied. The resulting differential equations determining the partition function and correlation functions are, remarkably, of the same type as certain equations appearing in the theory of integrable systems. They may be analyzed effectively through methods based upon the Riemann-Hilbert problem of analytic function theory and by related approaches to the study of nonlinear asymptotics in the large N limit.

Features

- Provides an in-depth examination of random matrices with applications over a vast variety of domains, including multivariate statistics, random growth models, and many others
- Applies the theory of integrable systems, a source of powerful analytic methods, to the solution of fundamental problems in random systems and processes
- Features an interdisciplinary approach that sheds new light on a dynamic topic of current research
- Explains and develops the phenomenon of "universality," in particular, the occurrence of the Tracy-Widom distribution for eigenvalues at the "edge of the spectrum," in the longest increasing subsequence of a random permutation and a variety of critical phenomena in the double scaling limit

Fields of interest

Theoretical, Mathematical and Computational Physics; Probability Theory and Stochastic Processes; Linear and Multilinear Algebras, Matrix Theory

Target groups

Research

Discount group

P

Due May 2011

2011. XII, 515 p. 55 illus., 3 in color. (CRM Series in Mathematical Physics) Hardcover

► **approx. \$209.00**
ISBN 978-1-4419-9513-1

E. F. Keane, Jodrell Bank Centre for Astrophysics, University of Manchester, United Kingdom

The Transient Radio Sky

The high time-resolution radio sky represents unexplored astronomical territory. This thesis presents a study of the transient radio sky, focusing on millisecond scales. As such, the work is concerned primarily with neutron stars. In particular this research concentrates on a recently identified group of neutron stars, known as RRATs, which exhibit radio bursts every few minutes to every few hours. After analysing neutron star birthrates, a re-analysis of the Parkes Multibeam Pulsar Survey is described which has resulted in the discovery of 19 new transient radio sources. Of these, 12 have been seen to repeat and a follow-up campaign of observations has been undertaken. These studies have greatly increased our knowledge of the rotational properties of RRATs and enable us to conclude that they are pulsars with extreme nulling and/or pulse-to-pulse modulation. Although the evolution of neutron stars post-supernova is not yet understood, it seems that RRATs fit into the emerging picture in which pulsar magnetospheres switch between stable configurations.

Features

- Reports the discovery of new Rotating Radio Transients
- Identifies and discusses pulsar properties of some of these RRATs
- Nominated as an outstanding contribution by the University of Manchester

Fields of interest

Astronomy, Astrophysics and Cosmology; Spectroscopy and Microscopy

Target groups

Research

Discount group

P

Due June 2011

2011. 237 p. 48 illus., 18 in color. (Springer Theses) Hardcover

► **approx. \$129.00**
ISBN 978-3-642-19626-3

Landolt-Börnstein

Numerical Data and Functional Relationships in Science and Technology – New Series

Editor-in-chief: W. Martienssen

Advanced Materials and Technologies

Part 2C2

T. Spittel, M. Spittel, TU Bergakademie Freiberg, Freiberg, Germany

H. Warlimont Neuses-Freigericht, Germany (Ed.)

Part 2: Non-ferrous Alloys – Light Metals

Subvolume C: Metal Forming Data - Volume 2: Materials - Group VIII: Advanced Materials and Technologies

Subvolume 2C of Group VIII deals with the forming data of metals. The content is subdivided into three parts with the present part 2 covering non-ferrous light metal alloys, i.e. about 45 material systems, in a compact, database-oriented form. The knowledge of the deformation behaviour of materials is of vital importance in scientific research and in technical applications. The increasing use of numerical simulation in research and practice describes the real processes the better the more precise the response of the material, the processes at the interface between the material and the tools or technical facilities are characterized. This behaviour is affected by process and material related parameters and is represented by physical and mechanical properties, plasticity curves and flow curves in the different states of the respective material. In this volume these properties are given for every single alloy along with its detailed composition and, where given, useful international standard notation. An extensive introduction presents the fundamental terms and concepts of forming with special attention to numerical simulation process related properties.

Field of interest

Physics, general

Target groups

Research

Due April 2011

2011. X, 640 p. 300 illus. Hardcover

► **\$4039.00**
ISBN 978-3-642-13863-8

Landolt-Börnstein

Numerical Data and Functional Relationships
in Science and Technology – New Series

Editor-in-chief: W. Martienssen

Advanced Materials and Technologies

Part 3

B. Eppich, B. Sumpf, O. Ambacher, K. Boucke,
A. E. Zhukov, H. Hoffmann, M. Kneissl,
P. M. Petersen, S. Sinzinger, U. Strauss, P. Unger,
M. Walthert, H. Weber, P. Loosen, R. Poprawe (Eds.)

Laser Systems, Part 3

The three volumes VIII/1A, B, C document the state of the art of "Laser Physics and Applications". Scientific trends and related technological aspects are considered by compiling results and conclusions from phenomenology, observation and experiments. Reliable data, physical fundamentals and detailed references are presented. In the recent decades the laser source matured to an universal tool common to scientific research as well as to industrial use. Today the main technical goal is the generation of optical power towards shorter wavelengths, shorter pulses, higher efficiency and higher power for applications in science and industry. Tailoring the optical energy in wavelength, space and time is a requirement for the investigation of laser-induced processes, i.e. excitation, non-linear amplification, storage of optical energy, etc. According to the actual trends in laser research and development, Vol. VIII/1 is split into three parts: Vol. VIII/1A with its two subvolumes 1A1 and 1A2 covers laser fundamentals, Vol. VIII/1B with its three subvolumes 1B1, 1B2 and 1B3 deals with laser systems and Vol. VIII/1C gives an overview on laser applications.

Fields of interest

Physics, general; Laser Technology, Photonics;
Engineering, general

Target groups

Research

Due June 2011

2011. 500 p. Hardcover

► \$4989.00

ISBN 978-3-642-14176-8

Landolt-Börnstein

Numerical Data and Functional Relationships
in Science and Technology – New Series

Editor-in-chief: W. Martienssen

Condensed Matter

Part 35D6

B. Mikhova, Bulgarian Academy of Sciences, Sofia,
Bulgaria, M. D. Lechner, Universität Osnabrück,
Osnabrück, Germany; V. Gupta, University of
Rajasthan, Jaipur, India (Eds.)

Part 6: Organic Metalloid Compounds

Subvolume D: NMR Data for Carbon-13

Nuclear Magnetic Resonance (NMR) is based on the fact that certain nuclei exhibit a magnetic moment, oriented by a magnetic field, and absorb characteristic frequencies in the radiofrequency part of the spectrum. NMR is now a leading technique and a powerful tool for the investigation of the structure and interaction of molecules. The present Landolt-Börnstein volume III/35 "Nuclear Magnetic Resonance (NMR) Data" is therefore of major interest to all scientists and engineers who use NMR to study the structure and the binding of molecules. Volume III/35 "NMR-Data" is divided into several subvolumes and parts. Subvolume III/35A contains the nuclei B-11 and P-31, subvolume III/35B contains the nuclei F-19 and N-15, subvolume III/35C contains the nucleus H-1, subvolume III/35D contains the nucleus C-13, subvolume III/35E contains the nucleus O-17, and subvolume III/35G contains the nucleus Se-77. More nuclei are planned for future volumes.

Fields of interest

Physics, general; Solid State Physics; Spectroscopy
and Microscopy

Target groups

Research

Due May 2011

2011. VIII, 500 p. Hardcover

► \$4989.00

ISBN 978-3-642-14248-2

Landolt-Börnstein

Numerical Data and Functional Relationships
in Science and Technology – New Series

Editor-in-chief: W. Martienssen

Condensed Matter

Volume 37B3

A. Takeuchi, D. V. Louzguine, Tohoku University,
Sendai, Japan; U. Carow-Watamura, Institute
for Materials Research, Sendai, Japan;
U. Carow-Watamura, Institute for Materials Research,
Sendai, Japan; J. Z. Yu, Tsinghua University, Beijing,
China, People's Rep. (Eds.)

Part 3: Systems from Cr-Fe-P to Si-W-Zr

Volume 37: Phase Diagrams and Physical
Properties of Nonequilibrium Alloys,
Subvolume C: Physical Properties of Ternary
Amorphous Alloys

Editor-in-chief: Y. Kawazoe,

In the present volume physical properties of ternary amorphous alloys are presented. For each of the 385 alloy systems the data, e.g., on density and structure, on thermal, mechanical, magnetic, electrical and optical properties, as well as on corrosion behavior, are provided in text, tables and figures. The data are published in three parts, the present 3rd part covering 148 alloy systems from Cr-Fe-P to Si-W-Zr.

Also available on www.springermaterials.com.

Features

- Technologically important materials
 - Editor and authors from the renowned Institute of Materials Research IMR of the Center for Computational Science at the Tohoku University Sendai Japan
 - Provides short introductions into the Physical
 - Properties used to characterize the amorphous alloys
- Clear presentation of the data in tables and figures

Fields of interest

Physics, general; Metallic Materials; Engineering
Design

Target groups

Research

Due June 2011

2011. Approx. 420 p. 931 illus. Hardcover

► \$4179.00

ISBN 978-3-642-14132-4

Q. Li, Chinese Academy of Sciences, Beijing, China

Digital Sonar Design in Underwater Acoustics

Principles and Applications

"Digital Sonar Design in Underwater Acoustics Principles and Applications" provides comprehensive and up-to-date coverage of research on sonar design, including the basic theory and techniques of digital signal processing, basic concept of information theory, ocean acoustics, underwater acoustic signal propagation theory, and underwater signal processing theory. This book discusses the general design procedure and approaches to implementation, the design method, system simulation theory and techniques, sonar tests in the laboratory, lake and sea, and practical validation criteria and methods for digital sonar design. It is intended for researchers in the fields of underwater signal processing and sonar design, and also for navy officers and ocean explorers.

Qihu Li is a professor at the Institute of Acoustics, Chinese Academy of Sciences, and an academicians of the Chinese Academy of Sciences.

Features

► The first book about the principles of digital sonar design in the field of underwater acoustics and ocean engineering ► Covers the most important topics in sonar design

Fields of interest

Acoustics; Electrical Engineering; Oceanography

Target groups

Research

Discount group

P

Due May 2011

Distribution rights in China: Zhejiang University Press

Jointly published with Zhejiang University Press

2011. 600 p. 300 illus. (Advanced Topics in Science and Technology in China) Hardcover

► \$269.00

ISBN 978-3-642-18289-1

M. D. Maia, Universidade de Brasilia, Brazil

Geometry of the Fundamental Interactions

On Riemann's Legacy to High Energy Physics and Cosmology

The Yang-Mills theory of gauge interactions is a prime example of interdisciplinary mathematics and advanced physics. Its historical development is a fascinating window into the ongoing struggle of mankind to understand nature. The discovery of gauge fields and their properties is the most formidable landmark of modern physics. The expression of the gauge field strength as the curvature associated to a given connection, places quantum field theory in the same geometrical footing as the gravitational field of general relativity which is naturally written in geometrical terms. The understanding of such geometrical property may help one day to write a unified field theory starting from symmetry principles. Of course, there are remarkable differences between the standard gauge fields and the gravitational field, which must be understood by mathematicians and physicists before attempting such unification. In particular, it is important to understand why gravitation is not a standard gauge field. This book presents an account of the geometrical properties of gauge field theory, while trying to keep the equilibrium between mathematics and physics. At the end we will introduce a similar approach to the gravitational field.

Features

► Explains some of the most complex theories in physics in clear and understandable language
► Provides comprehensive information about three of the four fundamental forces of nature
► Offers an explanation of Yang-Mills theory, with many theoretical properties given in the form of examples

Fields of interest

Theoretical, Mathematical and Computational Physics; Geometry; Elementary Particles, Quantum Field Theory

Target groups

Research

Discount group

P

Due May 2011

2011. VIII, 171 p. 22 illus. Hardcover

► \$129.00

ISBN 978-1-4419-8272-8

A. P. Potylitsyn, Tomsk Polytechnic University, Tomsk, Russia

Electromagnetic Radiation of Electrons in Periodic Structures

Periodic magnetic structures (undulators) are widely used in accelerators to generate monochromatic undulator radiation (UR) in the range from far infrared to the hard X-ray region. Another periodic crystalline structure is used to produce quasimonochromatic polarized photon beams via the coherent bremsstrahlung mechanism (CBS). Due to such characteristics as monochromaticity, polarization and adjustability, these types of radiation is of large interest for applied and basic research of accelerator-emitted radiation. The book provides a detailed overview of the fundamental principles behind electromagnetic radiation emitted from accelerated charged particles (e.g. UR, CBS, radiation of fast electrons in Laser flash fields) as well as a unified description of relatively new radiation mechanisms which attracted great interest in recent years. This are the so-called polarization radiation excited by the Coulomb field of incident particles in periodic structures, parametric X-rays, resonant transition radiation and the Smith-Purcell effect. Characteristics of such radiation sources and perspectives of their usage are discussed. The recent experimental results as well as their interpretation are presented.

Features

► Offers a unified description of electromagnetic radiation in periodic structures, both theory and experiments ► Discusses radiation generated in periodic structures in detail, plus diffraction radiation from relativistic electrons Presents Smith-Purcell radiation, radiation of fast electrons in laser flash fields, and polarization radiation excited by the Coulomb field of incident particles ► Provides in-depth information on diffraction radiation from relativistic electrons

Fields of interest

Particle Acceleration and Detection, Beam Physics; Applied and Technical Physics; Optics, Optoelectronics, Plasmonics and Optical Devices

Target groups

Graduate

Discount group

P

Due March 2011

2011. 250 p. 150 illus. (Springer Tracts in Modern Physics, Volume 243) Hardcover

► approx. \$179.00

ISBN 978-3-642-19247-0

A. Sanz, S. Miret-Artés, Instituto de Física Fundamental, Madrid, Spain

A Trajectory Description of Quantum Processes

Vol. 2 Applications

Trajectory-based formalisms are an intuitively appealing way of describing quantum processes because they allow the use of “classical” concepts. Beginning as an introductory level suitable for students, this two-volume monograph presents (1) the fundamentals and (2) the applications of the trajectory description of basic quantum processes. This second volume is focussed on simple and basic applications of quantum processes such as interference and diffraction of wave packets, tunneling, diffusion and bound-state and scattering problems. The corresponding analysis is carried out within the Bohmian framework. By stressing its interpretational aspects, the book leads the reader to an alternative and complementary way to better understand the underlying quantum dynamics.

Features

- Thorough introduction to, and treatment of, trajectory-based quantum-mechanical calculations
- Useful for a wide range of scattering problems

Fields of interest

Physics, general; Theoretical, Mathematical and Computational Physics

Target groups

Research

Discount group

P

Due August 2011

2011. Approx. 250 p. 22 illus., 2 in color. (Lecture Notes in Physics, Volume 831) Hardcover

► **approx. \$99.00**
ISBN 978-3-642-17973-0

H. C. Wichterich, University College London, Department of Physics and Astronomy, United Kingdom

Entanglement Between Noncomplementary Parts of Many-Body Systems

This thesis investigates the structure and behaviour of entanglement, the purely quantum mechanical part of correlations, in many-body systems, employing both numerical and analytical techniques at the interface of condensed matter theory and quantum information theory. Entanglement can be seen as a precious resource which, for example, enables the noiseless and instant transmission of quantum information, provided the communicating parties share a sufficient “amount” of it. Furthermore, measures of entanglement of a quantum mechanical state are perceived as useful probes of collective properties of many-body systems. For instance, certain measures are capable of detecting and classifying ground-state phases and, particularly, transition (or critical) points separating such phases. Chapters 2 and 3 focus on entanglement in many-body systems and its use as a potential resource for communication protocols. They address the questions of how a substantial amount of entanglement can be established between distant subsystems, and how efficiently this entanglement could be “harvested” by way of measurements. The subsequent chapters 4 and 5 are devoted to universality of entanglement between large collections of particles undergoing a quantum phase transition, where, despite the enormous complexity of these systems, collective properties including entanglement no longer depend crucially on the microscopic details.

Features

- Nominated as an outstanding contribution by University College London
- Treats two of the major challenges of modern physics: Entanglement and emergent properties (phase transitions)
- Provides an excellent theoretical basis for future research

Fields of interest

Quantum Physics; Strongly Correlated Systems, Superconductivity; Phase Transitions and Multi-phase Systems

Target groups

Research

Discount group

P

Due April 2011

2011. 100 p. 21 illus. (Springer Theses) Hardcover

► **approx. \$99.00**
ISBN 978-3-642-19341-5

Y. Zhang, Z. Nie, Xi'an Jiaotong University, Shaanxi, China; M. Xiao, University of Arkansas Fayetteville, Arkansas, USA

Coherent Control of Four-Wave Mixing

“Coherent Control of Four-Wave Mixing” discusses the frequency, temporal and spatial domain interplays of four-wave mixing (FWM) processes induced by atomic coherence in multi-level atomic systems. It covers topics in five major areas: the ultrafast FWM polarization beats due to interactions between multi-color laser beams and multi-level media; coexisting Raman-Rayleigh-Brillouin-enhanced polarization beats due to color-locking noisy field correlations; FWM processes with different kinds of dual-dressed schemes in ultra-thin, micrometer and long atomic cells; temporal and spatial interference between FWM and six-wave mixing (SWM) signals in multi-level electromagnetically induced transparency (EIT) media; spatial displacements and splitting of the probe and generated FWM beams, as well as the observations of gap soliton trains, vortex solitons, and stable multicomponent vector solitons in the FWM signals. The book is intended for scientists, researchers, advanced undergraduate and graduate students in Nonlinear Optics.

Features

- An up-to-date book on control and interactions of FWM processes in the time, frequency and spatial domain
- New forms of presentation and illustrations such as time-spatial interference are presented in the book
- A comprehensive and systematic framework for control and interactions of FWM processes will be constructed in this book

Fields of interest

Laser Technology, Photonics; Quantum Optics; Optics, Optoelectronics, Plasmonics and Optical Devices

Target groups

Research

Discount group

P

Due June 2011

Distribution rights in China: Higher Education Press

Jointly published with Higher Education Press

2011. 400 p. 200 illus. Hardcover

► **\$179.00**
ISBN 978-3-642-19114-5

But so also has been quantum mechanics, which describes the machinations of matter and energy on the atomic scale with unerring accuracy. Attempts to find coherent math that accommodates quantum weirdness with geometric gravity, though, have met formidable technical and conceptual roadblocks. At least that has long been so for attempts to understand ordinary space-time. In a similar way, perhaps the four-dimensional geometry of space-time could be encoded in the math of quantum physics operating in three-dimensions. Or maybe you need more dimensions – how many dimensions are required is part of the problem to be solved. Quantum mechanics is a fundamental theory in physics that provides a description of the physical properties of nature at the scale of atoms and subatomic particles. It is the foundation of all quantum physics including quantum chemistry, quantum field theory, quantum technology, and quantum information science. Classical physics, the description of physics that existed before the theory of relativity and quantum mechanics, describes many aspects of nature at an ordinary (macroscopic) scale, while We see how the standard matrix version of the Dirac equation can be reformulated in terms of a real space-time algebra, thus revealing a geometric meaning for the i in quantum mechanics. Next, it is examined in some detail how electroweak theory can be integrated into the Dirac theory and this way interpreted in terms of space-time geometry. Finally, some implications for quantum electrodynamics are considered. The presentation of real quantum electromagnetism is expressed in an addendum. The book covers both the use of the complex and the real languages and allows the reader acquaintance Quantum Mechanics in the has been added to your Cart. Add gift options. Buy used This book continues the fundamental work of Arnold Sommerfeld and David Hestenes formulating theoretical physics in terms of Minkowski space-time geometry. We see how the standard matrix version of the Dirac equation can be reformulated in terms of a real space-time algebra, thus revealing a geometric meaning for the i in quantum mechanics. Next, it is examined in some detail how electroweak theory can be integrated into the Dirac theory and this way interpreted in terms of space-time geometry. Finally, some implications for quantum electrodynamics are considered. The presentation of r