New Titles: November 2017

Physics

Physics

Forthcoming

P. Berman

Introductory Quantum Mechanics
A Traditional Approach Emphasizing Connections with Classical Physics

This book presents a basic introduction to quantum mechanics. Depending on the choice of topics, it can be used for a one-semester or two-semester course. An attempt has been made to anticipate the conceptual problems students encounter when they first study quantum mechanics. Wherever possible, examples are given to illustrate the underlying physics associated with the mathematical equations of quantum mechanics. To this end, connections are made with corresponding phenomena in classical mechanics and electromagnetism. The problems at the end of each chapter are intended to help students master the course material and to explore more advanced topics. Many calculations exploit the[...]
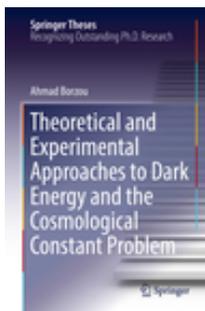
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2018. XV, 633 p. 99 illus. in color. (UNITEXT for Physics)
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December 27, 2017

A. Borzou

Theoretical and Experimental Approaches to Dark Energy and the Cosmological Constant Problem

This thesis represents a unique mix of theoretical work discussing the Lorentz theory of gravity and experimental work searching for supersymmetry with the Compact Muon Solenoid experiment at the Large Hadron Collider. It begins by reviewing a set of widely-discussed theoretical solutions to the cosmological constant problem, including a natural solution provided by the recently developed Lorentz gauge theory of gravity. The Schwartzschild metric, de Sitter space, and quantum versions of the theory are also discussed. The thesis then looks to supersymmetry for an alternative solution. The idea behind supersymme-

try is reviewed and an experimental search for supersymmetry is presented.[...]

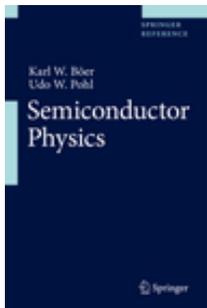More on www.springer.com/978-3-319-69631-7

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December 17, 2017

K.W. Böer, U. Pohl

Semiconductor Physics

This handbook gives a complete survey of the important topics and results in semiconductor physics. It addresses every fundamental principle and most research topics and areas of application in the field of semiconductor physics. Comprehensive information is provided on crystalline bulk and low-dimensional as well as amorphous semiconductors, including optical, transport, and dynamic properties.

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January 14, 2018

Forthcoming

M. Dresselhaus, G. Dresselhaus, S. Cronin, A. Gomes Souza Filho

Solid State Properties
From Bulk to Nano

This book fills a gap between many of the basic solid state physics and materials science books that are currently available. It is written for a mixed audience of electrical engineering and applied physics students who have some knowledge of elementary undergraduate quantum mechanics and statistical mechanics. This book, based on a successful course taught at MIT, is divided pedagogically into three parts: (I) Electronic Structure, (II) Transport Properties, and (III) Optical Properties. Each topic is explained in the context of bulk materials and then extended to low-dimensional materials where applicable. Problem sets

review the content of each chapter to help students to[...]
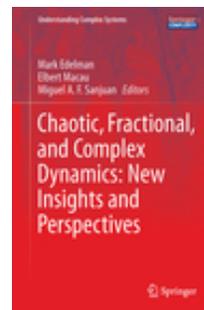
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December 17, 2017

M. Edelman, E. Macau, M.A.F. Sanjuan (Eds.)

Chaotic, Fractional, and Complex Dynamics: New Insights and Perspectives

The book presents nonlinear, chaotic and fractional dynamics, complex systems and networks, together with cutting-edge research on related topics.The fifteen chapters – written by leading scientists working in the areas of nonlinear, chaotic, and fractional dynamics, as well as complex systems and networks – offer an extensive overview of cutting-edge research on a range of topics, including fundamental and applied research. These include but are not limited to, aspects of synchronization in complex dynamical systems, universality features in systems with specific fractional dynamics, and chaotic scattering.As such, the book provides an excellent and timely snapshot of the current[...]

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December 19, 2017

Forthcoming

J. Hachtel

The Nanoscale Optical Properties of Complex Nanostructures

This book presents studies of complex nanostructures with unique optical responses from both theoretical and experimental perspectives. The theory approaches the optical response of a complex structure from both quantum-mechanical and semiclassical frameworks, and is used to understand experimental results at a fundamental level as well as to form a quantitative model to allow the design of custom nanostructures.

The experiments utilize scanning transmission electron microscopy and its associated analytical spectroscopies to observe nanoscale optical effects, such as surface plasmon resonances, with nanometer-scale spatial resolution. Furthermore, there is a focus in the dissertation[...]

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Forthcoming

J.H. Han

Skyrmions in Condensed Matter

This book summarizes some of the most exciting theoretical developments in the topological phenomena of skyrmions in noncentrosymmetric magnetic systems over recent decades. After presenting pedagogical backgrounds to the Berry phase and homotopy theory, the author systematically discusses skyrmions in the order of their development, from the Ginzburg-Landau theory, CP1 theory, Landau-Lifshitz-Gilbert theory, and Monte Carlo numerical approaches. Modern topics, such as the skyrmion-electron interaction, skyrmion-magnon interaction, and various generation mechanisms of the skyrmion are examined with a focus on their general theoretical aspects. The book concludes with a chapter on the[...]

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Forthcoming

E. Hanssen (Ed.)

Cellular Imaging
Electron Tomography and Related Techniques

This book highlights important techniques for cellular imaging and covers the basics and applications of electron tomography and related techniques. In addition, it considers practical aspects and broadens the technological focus by incorporating techniques that are only now becoming accessible (e.g. block face imaging). The first part of the book describes the electron microscopy 3D technique available to scientists around the world, allowing them to characterize organelles, cells and tissues. The major emphasis is on new technologies like scanning transmission electron microscopy (STEM) tomography, though the book also reviews some of the more proven technologies like electron[...]

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B. Harvey

Discovering the Cosmos with Small Spacecraft
The American Explorer Program

Explorer was the original American space program and Explorer 1 its first satellite, launched in 1958. Sixty years later, it is the longest continuously running space program in the world, demonstrating to the world how we can explore the cosmos with small spacecraft. Almost a hundred Explorers have already been launched. Explorers have made some of the fundamental discoveries of the Space Age. Explorer 1 discovered Earth's radiation belts. Later Explorers surveyed the Sun, the X-ray and ultraviolet universes, black holes, magnetars and gamma ray bursts. An Explorer found the remnant of the Big Bang. One Explorer chased and was the first to intercept a comet.The program went through a[...]

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N. Herisanu, V. Marinca (Eds.)

Acoustics and Vibration of Mechanical Structures– AVMS-2017
Proceedings of the 14th AVMS Conference, Timisoara, Romania, May 25–26, 2017

This book is a collection of papers presented at Acoustics and Vibration of Mechanical Structures 2017 – AVMS 2017 – highlighting the current trends and state-of-the-art developments in the field. It covers a broad range of topics, such as noise and vibration control, noise and vibration generation and propagation, the effects of noise and vibration, condition monitoring and vibration testing, modeling, prediction and simulation of noise and vibration, environmental and occupational noise and vibration, noise and vibration attenuators, as well as biomechanics and bioacoustics. The book also presents

analytical, numerical and experimental techniques for evaluating linear and non-linear[...]

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Forthcoming

S. Ichinokura

Observation of Superconductivity in Epitaxially Grown Atomic Layers
In Situ Electrical Transport Measurements

This thesis presents first observations of superconductivity in one- or two-atomic-scale thin layer materials. The thesis begins with a historical overview of superconductivity and the electronic structure of two-dimensional materials, and mentions that these key ingredients lead to the possibility of the two-dimensional superconductor with high phase-transition temperature and critical magnetic field. Thereafter, the thesis moves its focus onto the implemented experiments, in which mainly two different materials thallium-deposited silicon surfaces and metal-intercalated bilayer graphenes, are used. The study of the first material is the first experimental demonstration of both a[...]

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December 4, 2017

Forthcoming

M. Korzhik, A. Gektin (Eds.)

Engineering of Scintillation Materials and Radiation Technologies
Proceedings of ISMART 2016

This volume provides a broad overview of the latest achievements in scintillator development, from theory to applications, and aiming for a deeper understanding of fundamental processes, as well as the discovery and availability of components for the production of new generations of scintillation materials. It includes papers on the microtheory of scintillation and the initial phase of luminescence development, applications of the various materials, and development and characterization of ionizing radiation detection equipment. The book also touches upon the increased demand for cryogenic scintillators, the renaissance of garnet materials for scintillator applications,[...]

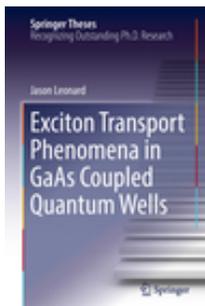More on www.springer.com/978-3-319-68464-2

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December 6, 2017

J. Leonard

Exciton Transport Phenomena in GaAs Coupled Quantum Wells

This thesis presents results crucial to the emerging field of indirect excitons. These specially designed quasiparticles give the unique opportunity to study fundamental properties of quantum degenerate Bose gases in semiconductors. Furthermore, indirect excitons allow for the creation of novel optoelectronic devices where excitons are used in place of electrons. Excitonic devices are explored for the development of advanced signal processing seamlessly coupled with optical communication. The thesis presents and describes the author's imaging experiments that led to the discovery of spin transport of excitons. The many firsts presented herein include the first studies of an excitonic[...]

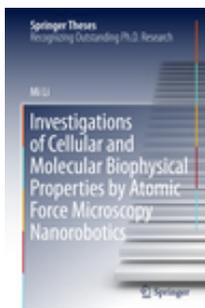More on www.springer.com/978-3-319-69732-1

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M. Li

Investigations of Cellular and Molecular Biophysical Properties by Atomic Force Microscopy Nanorobotics

This book presents methodological and application research in detecting cellular and molecular biophys-

ical properties based on atomic force microscopy (AFM) nanorobotics. Series methods for in situ label-free visualizing and quantifying the multiple physical properties of single cells and single molecules were developed, including immobilization strategies for observing fine structures of living cells, measurements of single-cell mechanics, force recognition of molecular interactions, and mapping protein organizations on cell surface. The biomedical applications of these methods in clinical lymphoma treatments were explored in detail, including primary sample preparation, cancer cell[...]
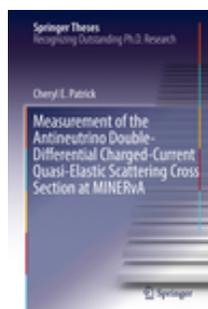
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C.E. Patrick

Measurement of the Antineutrino Double-Differential Charged-Current Quasi-Elastic Scattering Cross Section at MINERvA

This thesis represents the first double differential measurement of quasi-elastic anti-neutrino scattering in the few GeV range--a region of substantial theoretical and experimental interest as it is the kinematic region where studies of charge-parity (CP) violation in the neutrino sector most require precise understanding of the differences between anti-neutrino and neutrino scatter. This dissertation also presents total antineutrino-scintillator quasi-elastic cross sections as a function of energy, which is then compared to measurements from previous experiments. Next-generation neutrino oscillation experiments, such as DUNE and Hyper-Kamiokande, hope to measure CP violation in the[...]

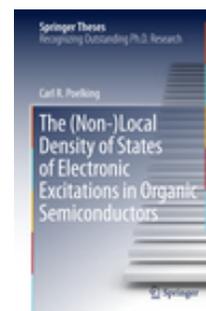More on www.springer.com/978-3-319-69086-5

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C.R. Poelking

The (Non-)Local Density of States of Electronic Excitations in Organic Semiconductors

This book focuses on the microscopic understanding of the function of organic semiconductors. By tracing the link between their morphological structure and electronic properties across multiple scales, it represents an important advance in this direction. Organic semiconductors are materials at the interface between hard and soft matter: they combine structural variability, processibility and mechanical flexibility with the ability to efficiently transport charge and energy. This unique set of properties makes them a promising class of materials for electronic devices, including organic solar cells and light-emitting diodes. Understanding their function at the microscopic scale – the[...]

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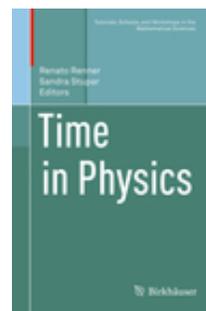
R. Renner, S. Stupar (Eds.)

Time in Physics

One of the most important questions concerning the foundations of physics, especially since the discovery of relativity and quantum theory, is the nature and role of time. In this book we bring together researchers from different areas of physics, mathematics, computer science and philosophy to discuss the role time plays in physics. There have been few books on this topic to date, and two of the key aims of the workshop and this book are to encourage more

researchers to explore this area, and to pique students' interest in the different roles time plays in physics.

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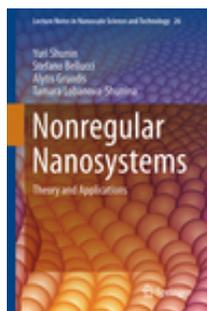
Y. Shunin, S. Bellucci, A. Gruodis, T. Lobanova-Shunina

Nonregular Nanosystems
Theory and Applications

This book presents a systemic view of nanophenomena in terms of disordered condensed media with characteristics arising at various hierarchical levels from nanoagents/nanoparticles through multiple technological interfaces to the creation of micro- or mesostructures with essential nanodimensional effects. These properties can be seen in various schemes for the functionalization of nanocarbon systems, namely, CNTs, GNRs, GNFs, carbon-based nanoaerogels, nanofoams, and so on, where nonregularities characterize surface nanointeractions and various nanointerconnects, resulting in both predictable and unpredictable effects. Beginning with nanosensing and finishing with other forms of[...]

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December 23, 2017

E.J. Sie

Coherent Light-Matter Interactions in Monolayer Transition-Metal Dichalcogenides

This thesis presents optical methods to split the energy levels of electronic valleys in transition-metal dichalcogenides (TMDs) by means of coherent light-matter interactions. The electronic valleys found in monolayer TMDs such as MoS_2, WS_2, and WSe_2 are among the many novel properties exhibited by semiconductors when thinned down to a few atomic layers, and have have been proposed as a new way to carry information in next generation devices (so-called valleytronics). These valleys are, however, normally locked in the same energy level, which limits their potential use for applications. The author describes experiments performed with a pump-probe technique using transient absorption[...]
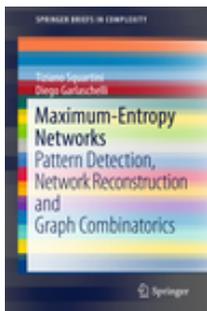
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T. Squartini, D. Garlaschelli

Maximum-Entropy Networks
Pattern Detection, Network Reconstruction and Graph Combinatorics

This book is an introduction to maximum-entropy models of random graphs with given topological properties and their applications. Its original contribution is the reformulation of many seemingly different problems in the study of both real networks and graph theory within the unified framework of maximum entropy. Particular emphasis is put on the detection of structural patterns in real networks, on the reconstruction of the properties of networks from partial information, and on the enumeration and sampling of graphs with given properties. After a first

introductory chapter explaining the motivation, focus, aim and message of the book, chapter 2 introduces the formal construction of[...]
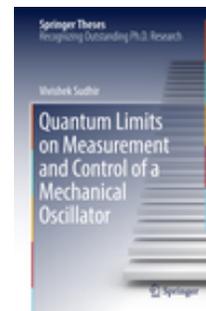
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V. Sudhir

Quantum Limits on Measurement and Control of a Mechanical Oscillator

This thesis reports on experiments in which the motion of a mechanical oscillator is measured with unprecedented precision. It offers a pedagogical approach to linear quantum measurement theory and includes a detailed guide to experimental aspects of precision interferometry. Lastly, the authors experimentally investigate the role of vacuum fluctuations in setting a fundamental limit to linear quantum feedback control. These results verify some of the central and long-standing predictions of quantum measurement theory applied to a macroscopic object; further, the thesis reports on some of the first feedback control experiments involving macroscopic objects in the quantum regime. The[...]

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December 5, 2017

Forthcoming

J. Wu

Calling Taikong: A Strategy Report and Study of China's Future Space Science Missions

This book describes the status quo of space science in China, details the scientific questions to be addressed by the Chinese space science community in 2016-2030, and proposes key strategic goals, space science programs and missions, the roadmap and implementation approaches. Further, it explores the supporting technologies needed and provides an out-

look of space science beyond the year 2030. "Taikong" means "outer space" in Chinese, and space science is one of the most important areas China plans to develop in the near future. This book is authored by WU Ji, a leader of China's space science program, together with National Space Science Center, Chinese Academy of Sciences, a leading[...]

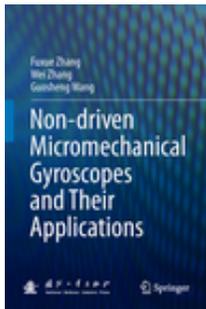More on www.springer.com/978-981-10-6736-5

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December 19, 2017

F. Zhang, W. Zhang, G. Wang

Non-driven Micromechanical Gyroscopes and Their Applications

This book comprehensively and systematically introduces readers to the theories, structures, performance and applications of non-driven mechanical and non-driven micromechanical gyroscopes. The book is divided into three parts, the first of which mainly addresses mathematic models, precision, performance and operating error in non-driven mechanical gyroscopes. The second part focuses on the operating theory, error, phase shift and performance experiments involving non-driven micromechanical gyroscopes in rotating flight carriers, while the third part shares insights into the application of non-driven micromechanical gyroscopes in control systems for rotating flight carriers. The[...]

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S. de la Barrera

Layered Two-Dimensional Heterostructures and Their Tunneling Characteristics

This thesis demonstrates that layered heterostructures of two-dimensional crystals graphene, hexagonal boron nitride, and transition metal dichalcogenides provide new and interesting interlayer transport phenomena. Low-energy electron microscopy is employed to study the surface of atomically thin WSe_2 prepared by metal-organic chemical vapor deposition on epitaxial graphene substrates, and a method for unambiguously measuring the number of atomic layers is presented. Using very low-energy electrons to probe the surface of similar heterostructures, a relationship between extracted work function differences from the layers and the nature of the electrical contact between them is[...]

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