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New books on physics and related sciences

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Gureev D M, Kamashev A V, Yamshchikov S V ***Mechanisms of Phase Transformations in Laser-Heated Iron and Steels*** (Samara: Samarskiĭ Universitet Publ., 1999) 164 pp. Bibliography: 227 refs. ISBN 5-230-06177-4.

Based on the current concept of the limit conditions exerted on a 'metal – external influence' system, this book develops models of the cooperative lattice transformation that occurs at phase transitions in iron and steels under strongly non-equilibrium conditions of high heating and deformation rates. The physics governing the laser-induced formation of structurally stressed surface states in iron – carbon-based alloys is investigated experimentally in relation to current theoretical knowledge. The book is intended for researchers and specialists in the theory of phase transformations and in laser material processing and will also be useful for undergraduate and post-graduate students in relevant disciplines. (Samarskiĭ Universitet Publ. regular mail address: 443011 Samara, ul. Akad. Pavlova 1)

Nagy D, Vertes A, Mörup S, Bondarevskiĭ S I, Nasredinov F S, Seregin P P, Andreev A A, Perfil'ev Yu D, Kamnev A A, Kopelev N S ***Mössbauer Spectroscopy of Frozen Solutions*** (Ed. by A Vertes and D Nagy) (Russian translation from the English under the editorship of Yu D Perfil'ev) (Moscow: Mir, 1998) 398 pp. Bibliography: 838 refs. ISBN 5-03-002872-2. RFBR project 98-03-46033. [Vertes A, Nagy D L (Eds) *Mössbauer Spectroscopy of Frozen Solutions* (Budapest: Akademia Kiado-Budapest, 1990)]

In this book, authors from Hungary, Denmark, and Russia address the principles of application of Mössbauer spectroscopy to the study of the geometrical, chemical, and magnetic structure of solutions and discuss experimental results. Owing to the book's theoretical introduction, no supplementary readings are needed to understand the material. The data presented in the monograph demonstrate the potentialities of the method to determine local atomic environment parameters, the parameters of a system as a whole, and details of physico-chemical transformations in solutions. With the consent of the Budapest edition editors, chapters on the Mössbauer spectroscopy of iron compounds in alkaline solutions and those on some recent advances in the Mössbauer spectroscopy of frozen solutions have been added. For researchers and undergraduate and post-graduate students concerned with the structure of solutions and solids. (Mir Publ. regular mail address: 129820 Moscow, 1st Rizhskiĭ per. 2; tel.: (7-095) 286-8388)

Uspekhi Fizicheskikh Nauk **171** (6) 685 – 687 (2001)
Translated by E G Strel'chenko

Ipatova I P ***Quantum Theory of Solids*** Part 1. ***Band Theory*** Textbook (St. Petersburg: StPbGTU Publ., 1998) 139 pp. Bibliography: 10 refs.

Ipatova I P ***Quantum Theory of Solids*** Part 2. ***Elementary Excitations*** Textbook (St. Petersburg: StPbGTU Publ., 1999) 108 pp. Bibliography: 6 refs.

This textbook outlines the major branches of the quantum theory of solids and presents much supplementary material. Chapters 1 – 4 of Part 1 discuss the band theory of solids, relying heavily on the ideas of symmetry theory in classifying electronic states in typical semiconductors. The presentation of the theory concludes with the 'Kane model' which provides a basis for the band spectrum analysis of tetrahedral and cubic crystals. Also covered are the concept of a 'hole', Luttinger's phenomenological Hamiltonian as a tool for describing holes, and superlattice band structures. Part 1 concludes with an electron band structure calculation for an empty lattice model of cubic symmetry. Part 2 (Chapters 5 – 7) gives particular attention to the concept of elementary excitations, which proved so fruitful in the theory of solids. Chapter 5 discusses interactions of elementary excitations, placing particular emphasis on the Coulomb interaction of charged current carriers — the interaction which determines screening effects, exciton optical properties, and metal – insulator type transitions, and which underlies the concept of the Fermi liquid. Much emphasis in this course is placed on imperfect crystals. Chapter 6 focuses on lattice vibrations in ionic and covalent crystals. Electron – phonon interactions of various types are discussed in Chapter 7. The manual is written for the modern semiconductor physics – nanoelectronics teaching & research improvement project based on the facilities of the RAS Physical-Technical Institute's branch of the St. Petersburg State Technical University's 'Semiconductor Physics and Nanoelectronics' department (Federal Special Purpose program 'Integratsiya', item 2.1, project 75). The textbook is intended for students and is oriented for the master's programs 'Micro- and nanoelectronics', 'Physics of semiconductors and dielectrics', 'Applied solid-state physics', 'Physics and technology of semiconductors', and 'Physics of reduced-dimension structures' as well as for training engineers and researchers in the disciplines 'Opto-electronic devices and systems', 'Materials and components of solid-state electronics', and 'Microelectronics and semiconductor devices'. Post-graduate students and doctoral competitors carrying out experimental and theoretical studies on the 'Physics of semiconductors and dielectrics', 'Solid-state physics', and 'Solid-state electronics, microelectronics, and nanoelectronics' will also benefit from reading this text. (St. Petersburg State Technical University Publ. regular mail address: 195251 St. Petersburg, ul. Politekhnicheskaya 29; tel. (7-812) 552-7717)

Volevich L R, Gindikin S G *A Mixed Problem for Partial Differential Equations with a Quasi-homogeneous Principal Part* With a supplement "Some Problems for Hyperbolic Equations over the Entire Time Axis" by Volevich L R and Shirikyan A R (Moscow: Éditorial URSS, 1999) 272 pp. Bibliography: 74 refs. ISBN 5-901006-64-X. RFBR project 98-01-14001.

This book examines the energy estimation apparatus applying to high-order evolution operators, namely, the approach which allows a unified exposition of a mixed problem for strictly hyperbolic and parabolic after Petrovskiĭ differential equations with varying coefficients. Along with these classical equations, the method is applicable to a new, unconventional class of q-hyperbolic equations. The first edition of this monograph [Gindikin S G, Volevich L R *Mixed Problem for Partial Differential Equations with Quasihomogeneous Principal Part* (Providence, R I: American Mathematical Society, 1996) xi, 233 pp.] appeared in 1996 in English. For this new edition, a number of misprints have been corrected and more reference material is presented. In addition, a supplement on hyperbolic equations over the entire time axis was written by A R Shirikyan and the first named author. Decidability problem in spaces of bounded periodic and almost periodic in time functions is investigated and the properties of asymptotic stability and exponential dichotomy are examined. Intended for specialists in partial differential equations and in the equations of mathematical physics, the books is also accessible to undergraduate and post-graduate students in mathematics. (Éditorial URSS Publ. contact information: tel./fax (7-095) 135-4423, tel. (7-095) 135-4246; e-mail: urss@urss.ru)

Tur'yan Ya I, Ruvinskiĭ O E, Zaĭtsev P M *Polarographic Catalymetry* (Moscow: Khimiya, 1998) 272 pp. Bibliography: 1150 refs. ISBN 5-7245-0712-9. RFBR project.

This book looks at how polarography is used in catalymetry for driving electrode, indicator catalytic reactions and for measuring their rates from the current intensity. It addresses the three most common types of electrocatalytic processes: the discharge of metal ions in ligand catalysis; the hydrogen evolution, and the reduction of oxidants. A detailed classification according to substrate and catalyst is given. In the analysis of the mechanisms of the relevant processes, intermediate complex-formation reactions and possibly parallel surface complexation reactions involving the electrode-adsorbed ligand catalyst were taken into account. Catalytic reaction rate constants are provided, and analytical balance applications of catalytic currents are illustrated with examples. For specialists in analytical and coordination chemistry, in electrochemistry, and bioelectrochemistry. (Khimiya Publ. regular mail address: 107076 Moscow, Stromynka 21, korp. 2)

Subbotin V I, Arnol'dov M N, Ivanovskiĭ M N, Mosin A A, Tarbov A A *Lithium* (Moscow: IzdAT, 1999) 263 pp. Bibliography: 92 refs. ISBN 5-86656-088-7. RFBR project.

This monograph, based on the authors' hitherto unpublished research materials, discusses the basic physical, thermophysical, physicochemical, and technological properties of pure or impurity-bearing lithium. It lists requirements on the purity of the metal as a coolant for nuclear power plants and describes techniques and equipment for purifying lithium and for monitoring and controlling its purity while in use. Coverage also includes the equipment of lithium facilities and how to work with lithium. Examples of its application in various areas of science and technology are described as well. For scientists, engineers, and technicians working in the development, maintenance, and exploitation of nuclear and thermonuclear power plants and lithium-based industrial systems. (Atomic Science and Technology Publishing (IzdAT) of the International Association of 'Chernobyl-Atom Unions' regular mail address: 123182 Moscow, ul. Zhivopisnaya 46; tel.: (7-095) 190-9097)

Geĭnts Yu É, Zemlyanov A A, Zuev V E, Kabanov A M, Pogodaev V A *Nonlinear Optics of Atmospheric Aerosols* (Novosibirsk: SO RAN Publ., 1999) 260 pp. Bibliography: 363 refs. ISBN 5-7692-0224-6. RFBR project 98-05-78009.

This monograph provides an analysis and generalization of a number of interrelated problems such as the influence of high-power laser radiation on the atmosphere material, propagation of intense laser radiation through the atmosphere, and the development of new methods for applying nonlinear effects to the diagnostics of the atmospheric state. The book provides a unified description of induced light scattering effects that occur in transparent spherical micron-sized particles due to the amplification of a spontaneous scattering wave by the resonance modes of the particles' internal optical field. Physical models for the interaction of high-power laser radiation with the particles of an absorbing aerosol are discussed, and quantitative estimates of how the microphysical parameters of aerosol formations and the energy and geometrical parameters of the radiation beam affect the attenuation properties of the atmosphere are presented. The book is intended for a wide range of researchers and undergraduate and post-graduate students in optics, atmospheric physics, and nonlinear optics and will also be a welcome source of information for the designers of laser-based technological and optical-location systems. (Siberian Branch RAN Publ. regular mail address: 630090 Novosibirsk, Morskoĭ prosp. 2)

Pogozhev I B *Conversations about the Similarity of Processes in Living Organisms* ('Nauchno-Populyarnaya Literatura' series) (Moscow: Nauka, 1999) 222 pp. Bibliography: 144 refs. ISBN 5-02-002356-6.

Written in an original format of the author's conversations with a number of specialists — a biologist, a physicist, a mathematician, a physician, a demographer, and a journalist — this book discusses the similarity aspects in processes taking place in living organisms. These are processes on which our health, birth and death rates, and other important things depend. The author draws on a wide range of physiological, medical, and demographical observations. The correlation between these observations and theoretical conclusions is illustrated by figures which require no mathematical background for their understanding. For those who wish to delve deeper into the matter, the mathematical proofs of the major points mentioned in the text are given in appendices, and a bibliography including original works, textbooks, and reference material is provided. The book will be useful to a wide variety of readers. (Nauka Publ. regular

mail address: 117864 Moscow, GSP-7, P.O. V-485, Profsoyuznaya ul. 90)

Nonlinear Phenomena in Open Systems A Collection Issue No. 11 (Ed. by Academician L N Lupichev) (Moscow: GIFTP Publ., 2000) 192 pp. ISBN 5-900840-11-7.

These collected articles continue the tradition of presenting primarily theoretical works which address relaxation processes in distributed media and examine the dynamical properties of active systems, known to be important in physics, technology, biology, and medicine. Emphasis is on practically interesting collective processes in nonlinear distributed-parameter systems and in open systems subject to various dynamical influences. Some of the papers present their material as a matter for discussion. In these, problems of potential interest to the scientific community are formulated on a tentative basis. Papers on topical problems in modern ecology are also included. The collection is intended for scientists, researchers, engineers, and technicians specializing in physics, biophysics, and mathematical modelling. Collected articles reflecting research in the State Institute of Physics and Technology Problems have been published periodically since 1989. (State Institute of Physics and Technology Problems Publ. regular mail address: 119034 Moscow, ul. Prechistenka 13/7)

Korogodin V I, Korogodina V L ***Information as the Life Foundation*** (Dubna: Publ. Center 'Feniks', 2000) 208 pp. Bibliography 153 refs. ISBN 5-87905-125-0. RFBR project 99-06-87033.

The focus of the treatise is on the discussion of life and information as the inherent aspects of information systems. It examines the properties of information and information systems and places spacial emphasis on the ability of the last systems to perform 'purposeful' actions and to break up into 'information' and 'dynamical' subsystems. The book also explores the progress of information from the early stages in the evolution of physical information systems to those involving biological information of genetic, behavioral, and logical nature. Special attention is given to the dynamics of biological information in the biosphere. Interaction between the noosphere and the technosphere (pertaining to information autogenesis) is also touched upon. For specialists as well as for a wide circle of readers interested in information theory, evolution, biology, and how the bio- and the technospheres interrelate. (Publ. Center 'Feniks' regular mail address: 141980 Moscow region, Dubna, per. Khlebozavodskoĭ 24, room 802)

ITMO (Institute of Precision Mechanics and Optics): ***Years and People*** Part 1 (Compiled by M I Poteev) (St. Petersburg: Iva Publ., StPb GITMO (TU), 2000) 284 pp.

This monograph describes milestones in the creation and development of the St. Petersburg State Institute of Precision Mechanics and Optics (Technical University) and provides concise information about its leaders and the most prominent professors and alumni. It contains notes and essays about the life and work of the contributors and the time they lived in. The book features amateur poems by the Institute's poetry lovers and is filled with photographs, maps, and diagrams illustrating the 100-year history of the StPb GITMO (TU). Of great interest is the current information about the status of the Institute in the year of its 100th anniversary and the assessment of what its development prospects are as it enters the third millennium. (Iva Publ. regular mail address: 197348 St. Petersburg, ul. Aérodromnaya 4)

Half a Century of World Ocean Studies: P P Shirshov Institute of Oceanology (Ed. by M E Vinogradov and S S Lappo) (Moscow: Nauka, 1999) 249 pp. ISBN 5-02-003627-7.

This collected articles commemorate the 50th anniversary of the P P Shirshov Institute of Oceanology of the Russian Academy of Sciences. Drawing on a vast body of factual material, this book traces the foundation, growth, and development of what is currently the largest single academic institution conducting comprehensive studies of the World Ocean and Russia's seas. The book's chapters cover in great length the history of the development of hydrophysics, bio-oceanology, marine geology, and marine engineering. Special attention is given to the contribution of the Institute founders, prominent scientists such as P P Shirshov, V G Bogorov, A D Dobrovol'skiĭ, V B Shtokman, L A Zenkevich, V P Zenkevich, and P L Bezrukov. The book is intended for a wide range of oceanographers and for those interested in the history of science. (Nauka Publ. regular mail address: 117864 Moscow, GSP-7, P.O. V-485, Profsoyuznaya ul. 90)

Theoretical and Applied Inorganic Chemistry (Editorial Board Chairman N T Kuznetsov) (Moscow: Nauka, 1999) 400 pp. ISBN 5-02-004485-7.

This collection is published to coincide with the 80th anniversary of the N S Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences. Papers by the Institute's leading researchers highlight major advances over the last ten years in both the Institute's traditional research areas (coordination chemistry, rare element chemistry, physicochemical analysis) and in newly-emerging research fields ranging from bio-inorganic chemistry to synergetics. For chemists, physicists, physical chemists and college teachers as well for undergraduate and post-graduate students. (Nauka Publ. regular mail address: 117864 Moscow, GSP-7, P.O. V-485, Profsoyuznaya ul. 90)

Compiled by *E V Zakharova*