

New books on physics and related sciences

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Silin V P *Introduction to Kinetic Theory of Gases* 3rd ed., rev. and enlarged (Moscow: URSS, 2013) 344 pp. ISBN 978-5-397-03547-7.

The text of this monograph covers the major points of a wide range of issues in the kinetic theory of gases. What the author give here are the main propositions of the theory and a description of its applications to the most typical problems. Much attention is paid to the kinetics of rarefied plasma. The author provides a general substantiation of the theory, which made it possible to go beyond the limits of Boltzmann gas kinetics. The physical generality of the presentation and a discussion of a large number of specific physical problems allow this book to serve as a helpful textbook for anyone studying physical kinetics. This book is intended for a wide range of physicists — students, teachers, and researchers. (Izdatel'skaya gruppa URSS: 117335 Moscow, Nakhimovskii prosp. 56; tel./fax +7 (499) 724-25-45; e-mail: orders@URSS.ru; URL: <http://urss.ru/>)

Ishchenko A A, Girichev G V, Tarasov Yu I *Electron Diffraction: Structure and Dynamics of Free Molecules and the Condensed Matter* (Moscow: Fizmatlit, 2013) 600 pp. ISBN 978-5-9221-1447-9.

The book focuses on recent achievements in the theory and experimental promise of the method of electron diffraction in the 4D spacetime continuum. It presents the foundations of the classical gas electronography (including the high-temperature variety) based on the concept of the potential energy surface. The introduction of time scan into the diffraction techniques using picosecond and femtosecond electron diagnostic pulses synchronized with the pulses of exciting laser radiation made it possible to develop techniques for ultrafast electron crystallography, time-resolved X-ray diffraction, and dynamic electron transmission microscopy, plus the tomography of the molecular state. It also becomes possible to visualize transient processes in the photoexcitation of free molecules and biological objects, and to analyze processes on surfaces and in nanostructures. The book was designed for a wide range of readers involving students, postgraduates, and researchers interested in the problems of the structure and dynamics of nanomaterials, and in the structures of matter in general. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel.: +7 (495) 334-74-21; fax: +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Tuchin V V *Optics of Biological Tissues: Methods of Light Scattering in Medical Diagnosis* (Translation from English,

edited by V V Tuchin) (Moscow: Fizmatlit, 2012) 816 pp. ISBN 978-5-9221-1422-6.

The monograph gives a comprehensive coverage of light scattering techniques which are developed for quantitative investigations of biological tissues and cell ensembles. Results are discussed of theoretical and experimental studies of photon transfer in biotissues, and techniques are described for solving direct and inverse problems of light scattering in randomly nonuniform and partly ordered media with multiple or single scattering. These results are used for modeling the processes of propagation of light fluxes in various biotissues in order to study their morphological status and functioning. The theoretical analysis is based on stationary and nonstationary theories of radiation transfer in strongly scattering media, the Mie theory for relatively opaque scattering media, and the numerical Monte Carlo technique which is used to solve direct and inverse problems of photon transport in multilayer media with complex boundary conditions. The book also discusses such fundamental optical phenomena as elastic and quasielastic (static and dynamical) scattering, diffraction, and interference of optical fields and photon density waves (intensity waves), fluorescence, photothermal and photoacoustical effects, and some others, as well as optical methods and instruments which open new approaches to biomedical applications. Among them, we should mention high-speed fiber-optic spectrophotometry and polarimetry, time and modulation systems for spectroscopy, visualization and microscopy, including photothermal and photoacoustic methods, methods of linear and nonlinear fluorimetry, the spectroscopy of photon correlation, speckle interferometry, coherent topography and tomography, phase, confocal, and heterodyne microscopy, partly coherent interferometry, and tomography. The book focuses much attention on the methods of measuring the optical parameters of biological tissues and blood, as well as methods of control of the optical characteristics of biotissues and blood needed to improve the quality of medical diagnostics, phototherapy, and high-precision laser surgery. The present edition is a translation of the monograph: Tuchin V *Tissue Optics: Light Scattering Methods and Instruments for Medical Diagnosis* 2nd ed. (Bellingham, Wash.: SPIE/International Society for Optical Engineering, 2007). (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Mishchenko E F, Sadovnichy V A, Kolesov A Yu, Rozov N Kh *Many-Faceted Chaos* (Moscow: Fizmatlit, 2012) 432 pp. ISBN 978-5-9221-1423-3.

The book addresses a number of fundamental issues related to nonlinear dynamics and chaos. Thus, new definitions of the invariant chaotic set of a dynamic system and chaotic attractor are introduced. These definitions make it possible

to detect a new type of chaotic behavior which is implemented in the noncompact and infinitely dimensional case — so-called turbulent chaos. The rich content of this phenomenon is illustrated with a specific example that admits rigorous mathematical analysis. Among other issues involved in this book, mention should be made of the problem of mathematical aspects of the theory of turbulence development according to Landau. Namely, the realizability of the Landau scenario in its generalized version is illustrated with a number of specific examples from various fields of the natural sciences. Certain other typical situations are also studied, in which changes in the controlling parameter of the system produce a chaotic attractor or when sufficiently many distinct chaotic attractors exist (the case of chaotic ‘bufferism’). For instance, a new method is suggested to take into account rare catastrophic events in systems with complicated behavior patterns, as well as a new approach to designing generators of chaotic oscillations. The book is intended for senior year students, postgraduates of mathematics and physics departments of universities, and specialists in applied mathematics, the theory of oscillations, nonlinear dynamics, and chaos. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Modern Tribology: Results and Promise (Ed. by K V Frolov) (Moscow: URSS, 2014) 480 pp. ISBN 978-5-382-01474-6.

The book gives a retrospective analysis of the history of evolving the main lines of inquiry in tribology in the 20th century and at the beginning of the 21st century — the science of friction, wear-and-tear, and lubrication in machines whose role is becoming increasingly more important as our technologies grow more complicated. Special attention is paid to the pioneering work of Russian scientists: A S Akhmatov, B V Deryagin, A Yu Ishlinsky, M V Korovchinsky, B I Kostetsky, I V Kragelsky, R M Matveevsky, A I Petrusevich, S V Pinegin, P A Rebinder, G I Fuks, M M Khrushchov and some others. A relation is traced between progress in modern technologies and the level of tribological studies, and the dependence of technological progress on the level of tribological knowledge. The book comprises 12 chapters, presenting a logical exposition of our current concepts of friction in machinery, mechanical strength of materials, methods of wear prediction, the thermal problem of friction, lubrication of solids, methods of tribotechnical testing, nanotribology, and anti-frictional materials and various coatings. The book is designed for researchers, postgraduates, and practising engineers who specialize in tribology, for senior year students at technical institutes and for all those who are interested in the history of technologies. (Izdatel'skaya gruppa URSS: 117335 Moscow, Nakhimovskii prosp. 56; tel./fax + 7 (499) 724-25-45; e-mail: orders@URSS.ru; URL: <http://urss.ru/>)

Azarenkov N A, Beresnev V M, Pogrebnyak A D, Kolesnikov D A Nanostructured Coats and Nanomaterials: Fundamentals of Coat Formation, Properties, Areas of Application, Specifics of Modern Nanostructured Systems in Nanotechnology (Moscow: URSS, 2013) 368 pp. ISBN 978-5-397-04035-8.

This textbook gives a classification of nanodimensional structures and analyzes their properties. Information is

generalized on manifestations of dimensional effects on the physical, mechanical, thermal, and other properties of nanostructured materials. Methods are discussed of creating isolated nanoparticles, ultradispersed powders, compact nanocrystalline, nanoporous, and amorphous materials, fullerenes, nanotubes, and nanostructured coatings. A brief description is given of the methods of studying nanostructured materials. Modern concepts concerning the formation of nanostructured and nanocomposite materials are given, obtained by ion-plasma methods of deposition. Also described are scanning and transmission positron microscopes for studying the profiles of distribution of vacancy defects as a function of depth and for scanning close to the surface. Principles are presented of near-field microwave diagnostics of nanomaterials and superconductors. Possibilities are demonstrated of applying nanostructured materials and coats in modern technologies. The book is intended for senior year students, postgraduates, and researchers. (Izdatel'skaya gruppa URSS: 117335 Moscow, Nakhimovskii prosp. 56; tel./fax + 7 (499) 724-25-45; e-mail: orders@URSS.ru; URL: <http://urss.ru/>)

Borisov S V, Magarill S A, Pervukhin N V Algorithms and Practical Techniques of Crystallographic Analysis of Atomic Structures (Novosibirsk: Publishing House of the Siberian Branch of the RAS, 2012) 112 pp. ISBN 978-5-7692-1279-6.

A method for analyzing crystalline structures has been implemented on the basis of an original approach to crystallization processes (algorithms of programs, wave-mechanics interpretation, methods of visualization). Certain examples are given in detail to demonstrate the entire procedure of analysis and serve as help for its individual application. General patterns of crystal formation have been formulated on the basis of the already analyzed crystalline structures of fluorides, oxides, sulfides, structures with cluster groups, and other complicated structures. The generality has been demonstrated of pseudotranslation ordering of atoms and atomic groups as the main mechanism of the process which builds the ‘force skeleton’ of the future structure. The book will be useful and interesting for both specialists in X-ray analysis, for crystallographers and crystal chemistry experts and for people with minimum physics and mathematics training who really wish to understand the mysterious phenomenon of ideal ordering in the matter surrounding us. (Izdatel'stvo SO RAN: 630090 P.O. Box 187 Novosibirsk, Morskoi pr. 2; <http://sibran.ru/>)

Romanov A A, Romanov A A, Trusov S V, Urlichich Yu M Satellite-Based Radio Tomography of the Ionosphere (Moscow: Fizmatlit, 2013) 350 pp. ISBN 978-5-9221-1462-2.

This monograph is concerned with the problems of the electrophysics of the ionosphere connected with methods and technologies of studying the state of the ionospheric plasma by using methods of cosmic tomographic radiomonitoring. Techniques are presented of modern and promising methods of satellite-based beam radiotomography, and analysis is conducted of on-board and ground-based measuring instruments and program packages that are applied to reconstruct vertical sections of electron concentration in the ionosphere. An original method is suggested for global radiotomographic probing using clusters of small-scale space devices. More than ten years of experience have been

generalized by the authors in the framework of the Federal Space Program and the Federal Target-Oriented Program “On Scientific and Educational Human Resources of Innovation in Russia for 2009–2013”, and also for implementing the grants of the RFBR (Russian Foundation for Basic Research) and international projects. The book is intended for senior year students, postgraduates, and researchers who specialize in applications-oriented problems of electrophysics, remote-control aerospace probing, and geophysics. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Fedyunin P A, Kazmin A I *Methods of Radio Wave Control of Parameters of Protection Coating in Aviation Technologies* (Ed. by P A Fedyunin) (Moscow: Fizmatlit, 2012) 182 pp. ISBN 978-5-9221-1414-1.

This monograph deals with microwave techniques of non-destructive control, which are based on the effect of the slow surface waves propagation in dielectric and magneto-dielectric materials on metal substrates. The methods already developed provide complete contactless measurements and make it possible to solve the problems of controlling electrophysical and geometric parameters and of internal defects of dielectric and magneto-dielectric materials on metal substrates, including protective coatings of aviation systems. Various aspects are analyzed of developing systems of control of the parameters of materials and coatings of metal surfaces, methods of justifying their technical promise, and methods of measurement automatization. The monograph is intended for engineers and researchers, as well as for students of technical educational institutes and students of military establishments who specialize in electrophysics and radiophysics. The monograph was reviewed by Professor V A Pon'kin, Dr.Sci. (Tech.), Honored Scientist of the Russian Federation, and by Professor V N Chernyshov, Dr.Sci. (Tech.), Honored Inventor of the Russian Federation. (Izdatel'stvo Fizmatlit: 117997 Moscow, ul. Profsoyuznaya 90; tel. +7 (495) 334-74-21; fax +7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

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