New books on physics and related sciences

Klimenko S V, Nikitin I N *Relativistic Strings: Mathematical Fundamentals, Visualization, Quantization* (Moscow: Izd. MFTI, 2004) 244 pp. ISBN 5-88835-014-1.

This book provides a systematic, concise, and broad covering of the mathematical fundamentals of the relativistic Nambu – Goto string model. Among the topics discussed are the classification of string singularities, exotic solutions, and the diverse approaches to nonanomalous quantization of the Nambu – Goto model in the spacetime of $d = 4$ physical dimension. A special chapter is devoted to modern mathematical modeling and computer visualization technologies with which many of the results presented in the book were achieved. The book will be of interest and value to a broad spectrum of researchers, faculty, and undergraduate and graduate students specializing in the fields of applied mathematics, theoretical physics, and mathematical modeling. (Moscow Institute of Physics and Technology Publ.: 141700 Moscow region, Dolgoprudnyĭ, Institutskiĭ per. 6b; tel. (7-095) 408-76-81, 409-93-28)

Zaĭtsev R O *An Introduction to Modern Statistical Physics* Lecture Course (Moscow: Editorial URSS, 2005) 400 pp. ISBN 5-354-01044-6.

This book grew out of a course which the author has taught since 2000 at the Moscow Institute of Physics and Technology. The first five lectures provide a brief exposition of the material usually covered in university courses, including the Gibbs description of ensembles and the physical properties of ideal Fermi and Bose gases. The remaining seven lectures are concerned with nonideal systems. Weakly nonideal Bose and Fermi gases are studied using the $(u - v)$-transformation method. Phase transition-point phenomena in superconductors and ferroelectrics are treated based on the self-consistent field method. To investigate universal physical laws near the critical point and in ferromagnetic phase transitions, parquet equations are employed. The critical exponents are calculated in a space of $(4 - \varepsilon)$-dimension. Topics covered in the last two lectures include diagram techniques, the proof of the Wick theorem, and the evaluations of amplitudes of the quasiparticle and nonstationary Josephson currents. The Appendix presents simple and original methods with which the mathematical relations encountered in the lectures can be obtained. The consistent derivation of basic second quantization formulas for nonrelativistic electrons is also covered. It will be suitable as a texbook for research workers and undergraduate and postgraduate students specializing in theoretical solid-state physics. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-

44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Sedov L I *Mechanics of Continua* In two volumes ("Classical University Textbook" Series) 6th reprinted ed. (St.-Petersburg: Izd. Lan', 2004) Vol. 1: 528 pp. ISBN 5-8114-0541-3; Vol. 2: 560 pp. ISBN 5-8114-0542-1.

In this two-volume monograph by Academician L I Sedov, mechanics, thermodynamics, electrodynamics, and the pertinent mathematical methods are presented in a unified framework from the viewpoint of their application to solid, liquid, and gaseous bodies and electromagnetic field theory. The mathematical methods, and in particular tensor calculus, are presented in an improved and simplified manner throughout the book. The first volume covers the general concepts and elementary models of the mechanics of continua, explains basic thermodynamic and electromagnetic properties, and introduces necessary equations. Addressed in the supplements are the author's original theories concerning the symmetry and construction of physical models. The second volume is concerned with specific theories and models encountered in hydrodynamics, gas dynamics, elasticity and plasticity theories, and the theory of cracks. The main ideas of the course are relevant to present-day problems in the scientific and theoretical cognition of nature, as well as to ones in technological progress, in particular, in aviation, rocket technologies, marine engineering, chemical transformations, astrophysics, etc. Recommended by the RF Ministry of Education as an undergraduate level textbook on the discipline of mechanics. The intended audience comprises specialists in the fields of engineering, mechanics, and thermodynamics, as well as faculty and students at the universities. (Lan' Publ.: 193029 St.-Petersburg, ul. Krupskoĭ 13; tel. (7-812) 567-85-78, 567-14-45; tel./fax (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: http://www.lanpbl.spb.ru/)

Emel'yanov V M, Timoshenko S L, Strikhanov M N *Introduction to Relativistic Nuclear Physics* (Moscow: Fizmatlit, 2004) 184 pp. ISBN 5-9221-0518-3.

The book discusses the phenomenological models of nuclear matter at high energy densities and temperatures. It reviews models for the spacetime evolution of nuclear matter, provides estimates for initial energy density in the collisions of relativistic heavy ions, discusses experiments on measuring signals of the formation of quark – gluon plasma in heavy ion collision, and describes an identical particle correlation method with which the size and time evolution of the particle emission region can be determined. Also included are the basics of the event analysis of heavy ion collisions, the basic ideas of ultraperipheral nuclear physics, and a brief review and analysis of experimental RHIC data. The book's first five chapters are based on the fifth-year degree course taught by one of the authors in the Department of Experimental and

Theoretical Physics at the Moscow Engineering Physics Institute. The content of the lectures corresponds to that of the course "Introduction to relativistic nuclear physics". The book is intended primarily for practising for nuclear specialists and senior undergraduate and postgraduate students in the disciplines "Elementary particle physics", "Experimental methods of nuclear physics", and "Micro- and cosmophysics". (Fizmatlit Publ.: 117997 Moscow, Profsoyuznaya ul. 90; tel. (7-095) 334-74-21; fax (7-095) 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

Nikolaev O S *Mechanical Properties of Liquid Metals. Extreme Properties of Minimal Single Crystals of Metals* ("Relata Refero" Series) (Moscow: Editorial URSS, 2004) 168 pp. ISBN 5-354-00829-8.

This book consists of two parts. The first considers a thermal method which is capable of estimating the mechanical properties of liquid metals and which applies to any of the three states of matter. A number of new results are obtained, and the mechanical properties of metals such as lithium, beryllium, aluminium, iron, tungsten, mercury, and francium are discussed in detail. The second part examines the physical properties of systems consisting of hundreds and thousands of metal atoms. It is found that such systems (referred to as 'minimal single crystals' of metals) require less cumulative heat for raising their temperature to the melting point and that they have a lower heat of fusion and a much lower melting point. The book can be useful to junior undergraduates, faculty running a general physics course, and practising metal engineers. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-16; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Peregudin S I *Wave Motions in Liquid and Granular Media* (St.-Petersburg: Izd. Sankt-Peterburgskogo Universiteta, 2004) 288 pp. ISBN 5-288-03577-6.

This monograph addresses problems on the propagation of waves in a liquid and on the surface of a granular medium. Its detailed coverage includes: low-amplitude internal waves above an uneven bottom; stratified fluid flow in a variable-depth channel; finite-amplitude waves in a two-layer liquid and how they affect a vertical obstacle; wave motions in a continuously stratified liquid, and low-amplitude surface waves in a granular medium that arise due to long- and short-wave propagation. The book is designed for research workers, engineers, and undergraduate students in various disciplines — including physics, mathematics, and mechanics — who are interested in the propagation of internal and surface waves in a liquid, and in waves on the surface of a granular medium. (St.-Petersburg University Publ.: 199034 St.-Petersburg, Universitetskaya nab. 7/9; tel. (7-812) 328-77-63; fax (7-812) 328-44-22; e-mail: books@dk2478.spb.edu; URL: http://www.unipress.ru/)

Lebedev V V *Fluctuation Effects in Macrophysics* (Moscow: Izd. MTsNMO, 2004) 256 pp. ISBN 5-94057-163-8.

This book evolved from the lecture course presenting the theory of fluctuation phenomena associated with macroscopic degrees of freedom. Along with the analysis of critical phenomena, the book discusses fluctuation effects in various condensed phases where these effects can be important, and presents the theory of dynamic fluctuations which applies both to equilibrium and nonequilibrium systems. The intended audience is undergraduate and postgraduate students in university physics departments, as well as researchers and engineers whose interests relate to the physics of condensed matter. (Publishing House of the Moscow Center for Continuous Mathematical Education: 121002 Moscow, Bol'shoĭ Vlas'evskiĭ per. 11; tel. (7-095) 241-72-85; fax (7-095) 291-65-01; e-mail: biblio@mccme.ru; URL: http://www.mccme.ru/)

Ovsyannikov L V *Lectures on the Fundamentals of Gas Dynamics* (Izhevsk: RKhD, 2003) 336 pp. ISBN 5-93972-201-6.

This book is designed as an introduction to the mathematical fundamentals of theoretical gas dynamics. It examines principles involved in constructing various gas dynamic models — from integral conservation laws to specific formulas for particular gas motions. The book also covers the group theoretical approach to the derivation of differential equations describing classes of partial solutions and applies qualitative analysis methods to a variety of specific problems. Graphic illustrations are provided to make the material easier to follow. It will be a valuable introductory text for mathematics and mechanics undergraduates, as well as for postgraduate students, faculty, and researchers in the mechanics of continua. (Science and Publishing Center 'Regular and Chaotic Dynamics': 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95, (7-095) 332-48-92; e-mail: subscribe@rcd.ru; URL: http://shop. rcd.ru/)

Varikash V M, Bolsun A I, Aksenov V V *A Problem Book In Statistical Physics* 2nd revised ed. (Moscow: Editorial URSS, 2004) 224 pp. ISBN 5-354-00726-7.

This manual collects and classifies problems from all basic areas of statistical physics. It contains problems that the authors have used for a number of years at practical sessions for students following programs in semiconductors and insulators at the Minsk Radio Engineering Institute. The authors' aim in compiling this book was to bring together problems scattered among numerous textbooks, manuals, and monographs, to classify them, and to provide students with a guide which will help them to master the lecture material. It is a well-known fact from higher education teaching experience that where students run into serious obstacles is in applying general physical laws to specific problems. The present manual is designed to help students to reinforce their theoretical knowledge and to prepare them for the study of special topics. The book contains problems of varying degrees of difficulty, so part of them can be assigned for classroom use, and part for personal study. The large variety of such problems offers freedom of choice to a practice session instructor. With a view to developing the skills and culture of problem solving, all problems, including simple ones, are provided with solutions. Clearly, the student is supposed to try a problem on his or her own before reading the authors' solution. There is pedagogical value in a student being able to see his or her mistake after failing to solve the problem. Because problems are solved after first studying the relevant theoretical material, only brief explanatory notes are given for basic formulas in section prefaces, which can by no

means be viewed as a logical and coherent exposition of theoretical aspects. The different mathematical methods and techniques used in the collection are well-established ones in statistical physics, and solving the problems requires no mathematical background beyond a college level course on differential and integral calculus. The content of this collection correlates with the program of the 'Statistical Physics' course in discipline 0604 and was influenced by the program, in particular in that a certain number of problems from thermodynamics were included. Because the course in quantum mechanics is taught in parallel with statistical physics, the book contains only a limited number of problems which require elaborate quantum mechanical computations for their solution. The book is designed for students in radio engineering but can also be used in classes at colleges and universities where statistical physics, thermodynamics, and solid state physics are studied. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Tsyvil'skiĭ V L *Theoretical Mechanics*: *A Technical College Textbook* 2nd ed., revised and enlarged (Moscow: Vysshaya Shkola, 2004) 343 pp. ISBN 5-06-004817-9.

This book presents a concise exposition of theory and problem solving methodology for basic theoretical mechanics courses at technical colleges. Its "Statics", "Kinematics", and "Dynamics" sections cover the fundamentals of the mechanics of a point mass and those of the mechanics of a system. The exposition of theory is accompanied by explanatory notes and worked examples. For typical problems, detailed solutions and methodological recommendations are provided. Self-tuition exercises include test questions to monitor students' understanding. The book is intended mainly for open and distance learning students in higher technical education as well as for personal study of the fundamentals of theoretical mechanics. (Vysshaya Shkola Publ.: 127994 Moscow, Neglinnaya ul. 29/14; tel. (7-095) 200-33-70; fax (7-095) 200-03-01; e-mail: info@v-shkola.ru; URL: http://www.v-shkola.ru/)

Vil'ke V G *Theoretical Mechanics* ("Classical University Textbook" Series) 3rd augmented ed. (St.-Petersburg: Izd. Lan', 2003) 304 pp. ISBN 5-8114-0520-0.

This book unifies classical mechanics with the mechanics of continua and presents them based on modern mathematical apparatus permitting a single axiomatic framework for systems with an infinite number of degrees of freedom. The distinctive features of the book are mathematical rigor, concise style, and unified approach to various models of classical mechanics and mechanics of continua. Much coverage is given to Lagrange and Hamilton mechanics as well as to variational principles which play a key role in constructing dynamic models of deformable solids, fluids and gases. A number of new methodological ideas are realized in the book. Added to the third edition are three appendices covering various problems studied in theoretical mechanics. Recommended by the RF Ministry of Education as an undergraduate level textbook for technical college students studying mathematics, applied mathematics, and mechanics. It will also be suitable as a textbook for university students in

physics, mathematics, and related disciplines, and for all those who wish to study basic models of classical mechanics and mechanics of continua. (Lan' Publ.: 193029 St.-Petersburg, ul. Krupskoĭ 13; tel. (7-812) 567-85-78, 567-1445; tel./fax (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: http://www.lanpbl.spb.ru/)

Kolmogorov A N, Dragalin A G *Mathematical Logic* ("Classical University Textbook" Series) 2nd ed. (Moscow: Editorial URSS, 2005) 240 pp. ISBN 5-354-00389-X.

Prominent Russian figures in logic and mathematics, A N Kolmogorov (1903 – 1987) and A G Dragalin (1941 – 1998), had a profound influence internationally on research into the logic and philosophy of mathematics. This edition comprises material from the textbooks *An Introduction to Mathematical Logic* and *Mathematical Logic* by the same two authors. It also contains additional chapters which provide a classical exposition of the concepts and results of mathematical logic as well as a discussion of the foundations of mathematics and explanation of the elements of the theory of sets and of the theory of algorithms. This text is based on a set of lectures on mathematical logic given by the authors in the Mechanics and Mathematics Department at M V Lomonosov Moscow State University. The exposition by the authors of the fundamentals of modern logic (including the logic of statements, the logic of predicates, elements of the axiomatic theory of sets and the theory of algorithms, Gödel's incompleteness theorem, and Hilbert's program for the foundations of mathematics) assumes no special background and is intended for a wide range of readers who have had no formal training in this field but take an interest in mathematical logic and philosophical problems of modern mathematics. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-16; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Kozlov A I, Logvin A I, Sarychev V A *Polarization of Radio Waves and the Polarization Structure of Radar Signals* (Moscow: Izd. Radiotekhnika, 2005) 704 pp. ISBN 5-93108-074-0.

This book presents material on the general theory of polarization of radio waves and their representations and examines the peculiarities of the polarization states of stochastic fields and signals. The book is designed for research workers, doctoral degree students, masters students, and engineers, and can be useful to faculty in radio engineering disciplines and in physics-related departments, as well as to bachelor students, senior undergraduates, and postgraduates. ('Radiotekhnika' Publ.: 107031 Moscow, K-31, ul. Kuznetskiĭ most 20/6; tel./fax (7-095) 921-48-37; e-mail: info@radiotec.ru; URL: http://www.radiotec.ru/)

Amstislavskiĭ Ya E *Classroom Experiments on Wave Optics of Diffusely Scattered Beams* (Moscow: Fizmatlit, 2005) 128 pp. ISBN 5-9221-0545-0.

New and original wide-aperture classroom demonstration experiments on wave optics and new laboratory measuring devices are described in this book intended for students of physics at teacher training colleges, for high school teachers,

and college physics faculty. (Fizmatlit Publ.: 117997 Moscow, Profsoyuznaya ul. 90; tel. (7-095) 334-74-21; fax (7-095) 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

Zhelobenko D P *Basic Structures and Methods in the Theory of Representations* (Moscow: Izd. MTsNMO, 2004) 488 pp. ISBN 5-94057-115-8.

The subject of this book can be defined as topological algebra, or, more precisely, the theory of algebro-topological structures that admit natural (i.e., operation-valued) representations in vector spaces. Among these are topological algebras, Lie algebras, topological groups, and Lie groups. The book details the fundamental aspects of the theory, including the theory of invariant measures on locally compact groups, and Sofus Lie theory concerning the linkage between Lie algebras and Lie groups. An especially detailed discussion is given of such topics as semisimple Lie algebras and groups, Banach algebras, and quantum groups. The book is intended for a wide range of readers, from undergraduates and postgraduates in physics, mathematics, and related disciplines to researchers displaying interest in the general problems of the modern theory of representations. (Publishing House of the Moscow Center for Continuous Mathematical Education: 121002 Moscow, Bol'shoĭ Vlas'evskiĭ per. 11; tel. (7-095) 241-72-85; fax (7-095) 291-65-01; e-mail: biblio@mccme.ru; URL: http://www.mccme.ru/)

Grankov A G, Mil'shin A A *Radio Emission from the Ocean-Atmosphere System and its Relation to Thermal and Dynamic Processes at the Interface* (Moscow: Fizmatlit, 2004) 168 pp. ISBN 5-9221-0526-4.

This book examines whether satellite microwave radiometric methods and tools can be used to analyze the thermal and dynamic interaction between the ocean and the atmosphere. Aspects covered include the physical principles and methods of determining the vertical turbulent flows of apparent, latent, and total heat and momentum on different time scales (days, months, seasons, years). It also demonstrates that the satellite-measured brightness temperature of the intrinsic microwave radiation of the ocean–atmosphere system close to the resonant absorption regions of the atmosphere's water vapor and molecular oxygen can be used as a direct characteristic of the heat and momentum fluxes. The key results of theoretical and applied importance were obtained through a combined analysis of data from the NEWFAEX-88 and ATLANTEX-90 experiments and the microwave radiometric measurements with the weather satellites of the DMSP series. The monograph is designed for research workers specializing in the remote radio probing of the ocean–atmosphere system, as well as for ocean scientists and meteorologists. Undergraduate and postgraduate students in related disciplines may also find it useful. (Fizmatlit Publ.: 117997 Moscow, Profsoyuznaya ul. 90; tel. (7-095) 334-74-21; fax (7-095) 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

Trukhin V I, Pokazeev K V, Kunitsyn V E, Shreĭder A A *Fundamentals of Ecological Geophysics* 2nd ed. (St.-Petersburg: Izd. Lan', 2004) 384 pp. ISBN 5-8114-0536-7.

This manual is intended for those studying the fundamentals of ecological geophysics. Topics covered include the basic concepts of the physics of the solid Earth, the sea, and the atmosphere as well as major global ecological problems of geophysics (global warming, pollution of the world's oceans, the ozone crisis, and geophysical phenomena leading to natural disasters like tsunamis, hurricanes, earthquakes, etc.). Also covered are various approaches to the description of the global ecological crisis, the simplest ecosystems and how they develop, the ecological problems of the power engineering, and prospects for nontraditional energy sources (the solar, tidal wave, wind, and geothermal power engineering). The material was developed from lectures given in the Physics Department at M V Lomonosov Moscow State University and at the Moscow State University of Applied Biotechnology. The book is intended mainly for undergraduates taking courses in geophysics, ecology, vital activity safety, and ecological physics. (Lan' Publ.: 193012 St.-Petersburg, ul. Krupskoĭ 13; tel. (7-812) 567-85-78, 567-14-45; tel./fax (7-812) 567-54-93; e-mail: root@lanpbl.spb.ru; URL: http://www.lanpbl.spb.ru/)

Mitrofan Fedorovich Stel'makh (Ed. by A A Kazakov) (Moscow: Fizmatlit, 2004) 192 pp. ISBN 5-9221-0014-9.

December 21, 2003 marked the 85th birthday of Mitrofan Fedorovich Stel'makh, a leading figure in the field of microwave and laser technologies, whose curriculum vitae includes Doctor of Technical Sciences, Professor, and winner of the USSR State Award, and who is among founders of the Russian laser technology and the founder and first Director of the 'Polyus' Research Institute. The collection contains reminiscences of the scientist's relatives, friends, colleagues, and students, and includes unique photos. Also featured in the book are Stel'makh's lesser known paper of 1968 on the status of quantum electronics at the time and his unpublished letter to a ''Communist Youth Union'' newspaper in Khar'kov (1979). The book fills a gap — due to the classified nature of Stel'makh's research activity — in what the science and engineering community at large has until now been allowed to know about his creative life and career. (Fizmatlit Publ.: 117997 Moscow, Profsoyuznaya ul. 90; tel. (7-095) 334-74-21; fax (7-095) 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

Kovalevskaya T E, Ovsyuk V N, Belokonev V M, Degtyarev E V *Photonics: A Dictionary of Terms* (Ed. by V N Ovsyuk) (Novosibirsk: Izd. SO RAN, 2004) 342 pp. ISBN 5-7692-0691-8.

Part dictionary, part handbook, this edition contains about 7,000 terms covering 'photonics', a relatively new and broad science and technology field which studies methods for generating and practically applying light and other photon-quantized radiations. The dictionary covers such subjects as optics, optoelectronics, photoelectronics, semiconductors, optical materials, the physics and engineering of lasers, radiation receivers, heat vision and night vision, image processing, etc. The intended audience comprises research workers and specialists in photonics and related science and engineering fields, as well as faculty and undergraduate and postgraduate students in related disciplines. (RAS SB Publ.: 630090 p/b 187, Novosibirsk, Morskoĭ prosp. 2; tel./fax (7-3832) 30-84-66; fax (7-3832) 33-37-55); e-mail: sprice@ad-sbras.nsc.ru; URL: http://www.psb.ad-sbras.nsc.ru/)

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