

New books on physics and related sciences

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Zinenko V I, Sorokin B P, Turchin P P *Fundamentals of Solid State Physics* University textbook (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 336 pp. ISBN 5-94052-040-5.

While maintaining a high level of scientific rigour, this book provides a quite accessible presentation of the fundamentals of solid-state physics, including the elastic, thermal, electrical, and magnetic properties of ideal and real (defect-containing) crystalline solids (metals, insulators, semiconductors, magnets) with account for their structure, symmetry, and the type of bonding. For both students and lecturers of higher education institutions. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-0314; e-mail: fizmatlit@narod.ru; URL: <http://www.fizmatlit.narod.ru/>)

Sigov Yu S *Computing Experiments: Bridging the Past and the Future of Plasma Physics* Selected Works (Compiled by G I Zmievskaya and V D Levchenko) (Moscow: Fizmatlit, 2001) 288 pp. ISBN 5-9221-0193.

The monograph commemorates Yuriĭ Sergeevich Sigov and contains original works of this scientist. Fundamental mechanisms governing development of strong and moderate turbulence are examined, which have become classic in modern physics after the author first discovered them in his numerical experiments of the 1970–1990s. The book addresses problems related to self-organization and dissipation in plasma, such as the formation of coherent wave packets in beam–plasma systems, the generation of super-thermal electrons and ion sound at the kinetic stage of the Langmuir collapse, and some others. Coverage also includes methodical problems related to the efficiency of the numerical methods developed by Sigov's school, from the modified macroparticle method to a modern object-oriented plasma model. The book discusses the potentialities and prospects of the computing experiment as a method of theoretical physics for use in basic and applied studies of plasma and plasma-like media. Fragments of memoirs about Yu S Sigov by his friends and colleagues are included in the book. For specialists in physics studying strongly nonequilibrium (fusion and astrophysical) plasma and plasma-like media by applying the methods of applied mathematics. (OOO IF Fizmatlit: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-7421, 334-7620; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Mikhaĭlov V P *Lectures on the Equations of Mathematical Physics* University textbook ("Lectures at the MFTI Higher

Mathematics Department" Series) (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 208 pp. ISBN 5-94052-026-x.

This book is based on lectures given by the author to students at the Moscow Physicotechnical Institute. Along with the traditional matters for such courses — the Cauchy problem, mixed problems for hyperbolic and parabolic equations, boundary-value problems for elliptic equations — a number of problems important from the application standpoint were considered, such as weak discontinuities in the solutions of differential equations. In presenting the basic results, direct methods of mathematical physics derived from elements of variational calculus are widely used. Recommended as an educational supplier for students taking the Applied Mathematics and Physics professional qualification by the Educational Methods Council of the Moscow Physicotechnical Institute (State University). For students in mathematics, physics, and engineering. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-03 14; e-mail: fizmatlit@narod.ru; URL: <http://www.fizmatlit.narod.ru/>)

Édel'man V S *Close to Absolute Zero* ("Beauty of Science" Series) 2nd revised ed. (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 192 pp. ISBN 5-94052-029-4.

This book provides an account of physical phenomena observed at temperatures near absolute zero. From its text the reader will learn the temperature of the Universe and how it was measured; how very low temperatures were obtained under laboratory conditions; what levitating electrons, and what metals and two-dimensional conductors are, and finally, what superconductivity is. For senior pupil of secondary schools, school teachers, lecturers and all who are interested in physics. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-03 14; e-mail: fizmatlit@narod.ru; URL: <http://www.fizmatlit.narod.ru/>)

Zhuravlev V F *Fundamentals of Theoretical Mechanics* 2nd revised ed. (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 320 pp. ISBN 5-94052-041-3.

This book is distinct from typical textbooks on the subject in that it presents a deeper analysis of the fundamentals of classical and relativistic mechanics, with both paradigms treated within a single framework. The course covers elements of the theory of Lie groups at a level needed for the application of group-theoretical ideas in modern mechanics and physics. The traditional branches of theoretical mechanics have been subjected to serious methodical revision — first, to simplify as much as possible the presentation of the fundamental concepts, theorem proofs, and basic methods, and second, to replace outdated ideas by more effective

modern ones (the apparatus of the theory of finite rotations being an example). For researchers, teachers, undergraduate and post-graduate students. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-03 14; e-mail: fizmatlit@narod.ru; <http://www.fizmatlit.narod.ru/>)

Zhukarev A S, Matveev A N, Peterson V K *Problems of Higher Complexity in a Course in General Physics* 2nd ed. (Moscow: Éditorial URSS, 2001) 192 pp. ISBN 5-8360-0411-0.

This book looks into solutions of problems used at higher-complexity seminars for the first-year and second-year students taking a course in general physics at the MSU Physics Department. The problems cover mechanics, molecular physics, electromagnetism, and optics. Along with original problems, the most typical high-complexity problems of the course are included. For teachers and students in general physics. (Éditorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203, RAS Institute for System Analysis; tel./fax (7-095) 135-44 23, 135-42 46; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Kornev K G *Foams in Porous Media* (“Mechanics and Its Applications in Engineering and Technology” Series) (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 192 pp. ISBN 5-94052-042-1.

This book provides a state-of-the-art overview of a class of problems that arise in treating the formation and flow of foams in porous media, and offers a critical analysis of the existing experimental material. The book covers the formation of foam structures in porous media and the stability of foam films under static and dynamic conditions. Particular emphasis was placed on physical mechanisms responsible for anomalous foam drag in porous media. The aim of the book is to attract the attention of the broad section of scientific community to a new interdisciplinary problem and to stimulate further studies. For undergraduates and post-graduates in physics and chemistry as well as researchers concerned with multiphase media. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-03 14; e-mail: fizmatlit@narod.ru; URL: <http://www.fizmatlit.narod.ru/>)

Kuptsov A Kh *Fourier Spectra of Polymer Raman Scattering and Infrared Absorption* A handbook (Moscow: Fizmatlit, 2001) 656 pp. ISBN 5-9221-0188-9.

This handbook provides information on the vibrational spectra of 581 polymers (organic, bioorganic, element-organic, and inorganic) and a number of monomers and associated materials. Raman and IR absorption spectra correspond to the intramolecular vibrations of atoms chemically bonded into macromolecular structures. The reason they are called Fourier spectra in the handbook's title is that both were obtained with Fourier spectrometers. For both kinds of spectra, conditions for the equiprecision digital-form recording of them on the same samples and with the equipment of the same laboratory were created. The handbook is actually a database, in which four indices, a newly developed polymer classification, and CAS registry

numbers help the reader in the search for the required information. Graphs and tables of data are preceded by an introductory section explaining the physical nature of Raman scattering and infrared absorption and describing the ‘spectrum–structure’ correlation, which is the basis of the numerous successful applications of optical vibrational spectroscopy. The same section discusses sample preparation and measurement conditions and provides a bibliography of as many as 77 original works and reference books on the Fourier spectroscopy of the Raman scattering of light by polymers; a major shortcoming of the reference sources (concentration on IR absorption spectra and the lack of RS spectra) is overcome in this volume. For scientists involved in chemistry, physics, biochemistry, and biophysics, and for industrial laboratory workers and all others engaged in the production of polymer elements, films, fibers, and composites. (OOO IF Fizmatlit: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Abramov A A *Introduction to Tensor Analysis and the Riemannian Geometry* University textbook (“Lectures at the MFTI Higher Mathematics Department” Series) (Moscow: Izd. Fiziko-Matematicheskoi Literatury, 2001) 112 pp. ISBN 5-94052-039-1.

This book is based on lectures given by the author to lower-course students at the Moscow Physicotechnical Institute. It briefly summarizes the basic results from tensor algebra, tensor analysis, and Riemannian geometry. The only prerequisites are general college courses in mathematical analysis, linear algebra, and the theory of ordinary differential equations. Recommended as an educational supplier for students taking the Applied Mathematics and Physics professional qualification by the Educational Methods Council of the Moscow Physicotechnical Institute (State University). For students in mathematics, physics, and engineering, and for scientific workers. (Fiziko-Matematicheskaya Literatura Publ.: 117071 Moscow V-71, Leninskiĭ prospekt 15; tel.: (7-095) 952-49 25, 955-03 30; fax: (7-095) 955-03 14; e-mail: fizmatlit@narod.ru; URL: <http://www.fizmatlit.narod.ru/>)

Sergeev A G *Kählerian Geometry of Loop Spaces* (“Modern Mathematical Physics. Problems and Methods” Series, issue No. 4) (Moscow: MTsNMO Publ., 2001) 128 pp. ISBN 5-94057-005-4.

The fourth book in the “Modern Mathematical Physics. Problems and Methods” series addresses Kählerian geometry of the loop spaces of compact Lie groups. The text is based on the lectures given by the author to undergraduate students at Moscow State University and Moscow Independent University (the autumn of 1995 — the spring of 1996). On the one hand, the loop space of a compact Lie group is a phase manifold of string theory and, on the other, it is one of the most interesting examples of infinite-dimensional Kählerian manifolds. It has in fact a single natural symplectic form and possesses a set of complex structures which are compatible with it and are parameterized by points of another interesting infinite-dimensional Kählerian manifold, namely a factor group of the circumference diffeomorphisms with respect to modulus of rotation. The latter manifold, on the contrary, has

a natural complex structure and a 2-parametric family of symplectic forms compatible with it. It is the study of the Kählerian geometry of these two infinite-dimensional manifolds which comprises the subject matter of this book. The book is intended for undergraduate and post-graduate students interested in mathematical physics, complex analysis, functional analysis, and differential geometry. (MTsNMO Publ. contact information: 121002 Moscow, Bol'shoi Vlas'evskii per. 11; tel.: (7-095) 241-7285; fax (7-095) 291-6501; e-mail: biblio@mccme.ru; URL: <http://www.mccme.ru/>)

Bolibrukh A A *Maxwell Equations and Differential Forms* (Moscow: MTsNMO, 2002) 24 pp. ISBN 5-94057-022-4.

This booklet was developed from notes for the lectures given by the author to the participants of the Summer School "Modern Mathematics" in Dubna (Moscow Region) on 16 and 19 July 2001. It examines the basic concepts of differential geometry — differential forms, fiber bundles and connectivities — and their use in modern physics. The booklet addresses first- and second-year college students. (Publishing House of the Moscow Continuous Mathematical Education Center: 121002 Moscow, B. Vlas'evskii per. 11; tel.: (7-095) 241-7285; e-mail: biblio@mccme.ru; URL: <http://www.mccme.ru/>)

Menskiĭ M B *Quantum Measurements and Decoherence* (Moscow: Fizmatlit, 2001) 232 pp. ISBN 5-9221-0071-8.

This book examines the quantum theory of measurements, which is gaining a resurgence of interest due to new applications to quantum information technology. Decoherence effects in a measured system are analyzed, and simple description techniques for a wide class of quantum measurements are given, including the method of complex Hamiltonians for continuous measurements or continuous decoherence. The conceptual problems of quantum mechanics are also addressed. The text will be of interest to scientific workers, postgraduates, and senior undergraduates specializing in quantum mechanics, mathematical physics, and the theory of stochastic processes. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-7421, 334-7620; e-mail: fmlsale@maik.ru; <http://www.fizmatlit.ru>)

USSR Atomic Project: Documents and Materials In 3 volumes. Vol. II. *Atomic Bomb. 1945–1954*. Books 1, 2 (General Editor L D Ryabev) (Moscow: Fizmatlit, 2001) Book 1: 719 pp. ISBN 5-85165-402-3; Book 2: 640 pp. ISBN 5-9221-0112-9.

This second volume includes hitherto unpublished documents of the period 1945–1954, reflecting the emergence of the atomic industry and the creation of the first atomic bombs in the USSR. The books of volume II comprise documents describing the efforts of the Soviet Government, the Special Committee, the First Main Directorate (later the USSR Ministry of Middle Engineering Industry), and those of industry, academy, Soviet intelligence bodies, and prominent scientists and specialists to carry out the Soviet atomic project. The first book of volume II contains documents of the 1945–1949 period which culminated in the creation and testing of the first atomic bomb in the USSR. The second

book of volume II contains documents from August 1945 to August 1946 pertaining to the creation and development of the atomic industry in the USSR and the organization of research work in the field. The book is prepared by the RFYaTs-VNIIÉF (Sarov) and is intended for all those interested in the history of the Soviet atomic project. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-7421, 334-7620; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Mogilevskii É I *Fractals on the Sun* (Moscow: Fizmatlit, 2001) 154 pp. ISBN 5-9221-0179-x.

This book addresses a number of phenomena related to the discrete structure of magnetized plasma ('fine structure') on the Sun and seen at all levels of observation. It is shown that the nature of the basic phenomena of solar activity — flares and coronal mass ejections, the structural features of the spots and large-scale magnetic fields — is hard to understand within the framework of the magnetic hydrodynamics of continuous media. The author discusses the model of magnetized solar plasma consisting of small-scale self-similar elements (fractals) which self-organize themselves into systems (clusters) and macroobjects similar to fractals 'in certain respects.' The quasi-stationary fractal structures characteristic of solar activity in a nonlinear solar medium are related to wave processes, namely, the formation of solitons which actively participate in solar flares. The self-organized criticality process is treated as an energy-minimization one for the ensemble of fractal elements. The monograph is intended for scientific workers, postgraduates, and senior undergraduates specializing in the physics of the Sun, solar activity, and helio-terrestrial physics. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-7421, 334-7620; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Mechanics of Contact Interactions (Edited by I I Vorovich and V M Aleksandrov) (Moscow: Fizmatlit, 2001) 670 pp. ISBN 5-9221-0154-4.

This book provides an authoritative review of the major advances that have been made by Russian researchers over the last 25 years in the mechanics of contact interactions of deformed bodies, both with respect to the methods of solution and the results achieved. Whenever necessary, the studies of foreign authors are also covered. The book consists of seven chapters. Chapter 1 discusses solution methods for contact problems. Static contact problems in a nonclassical formulation are considered in Chapter 2. Stationary and nonstationary dynamical contact problems are treated in Chapters 3 and 4, respectively. Chapter 5 covers contact problems in tribology, Chapter 6 those for complex media, and Chapter 7 discusses the contact-related failure problems. For researchers, engineers and undergraduate and post-graduate students interested in problems in the mechanics of continuous media. (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-7421, 334-7620; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Kingsep A S, Lokshin G P, Ol'khov O A *Foundations of Physics*. Vol. 1. *Mechanics, Electricity and Magnetism, Vibrations and Waves, Wave Optics* (Edited by A S Kingsep) (Moscow: Fizmatlit, 2001) 560 pp. ISBN 5-9221-0164-1.

This book is the first volume of a two-volume course in general physics designed in accordance with baccalaureate-degree technical college programs. The textbook, the winner of the RF Ministry of Education competition, is intended for undergraduates of engineering colleges with an extended program in physics as well as for classical university courses in physics and mathematics. While the authors present their subject with a sufficiently high level of formalization, no mathematical background beyond an engineering college program is needed because all additional information required is incorporated directly in the course. The first volume covers mechanics, electrodynamics, and the physics of wave processes (including physical optics). (Fizmatlit Publ.: 117864 Moscow, ul. Profsoyuznaya 90; tel./fax: (7-095) 334-74 21, 334-76 20; e-mail: fmlsale@maik.ru; URL: <http://www.fizmatlit.ru>)

Petkevich V V *Foundations of Continuum Mechanics* (Moscow: Éditorial URSS, 2001) 400 pp. ISBN 5-8360-0243-6.

The main focus of this educational supplier is on the mechanics of liquids and gases. The book presents the kinematics of continuous medium in the Eulerian and Lagrangian coordinates, discusses the dynamics of an ideal liquid (including the fundamentals of vortex theory), and examines the complete system of equations of compressible ideal fluid dynamics with account for the relevant equations of thermodynamics. Also covered are the viscous fluid dynamics and the fundamentals of the theory of turbulence and magnetic hydrodynamics. The textbook is the first to present the theory of figures of equilibrium for rotating, gravitating fluid bodies. The author also examines the fundamentals of elasticity theory, derives the static and dynamic equations of elastic bodies, discusses the conditions of validity of the model of a perfectly rigid body, and proposes solutions for a number of classical problems of continuum mechanics. For undergraduate students in physics, mechanics, and mathematics as well as lecturers in theoretical mechanics and continuum mechanics. (Éditorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203, RAS Institute for System Analysis; tel./fax (7-095) 135-44 23, 135-42 46, e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Petrov B M *Electrodynamics and the Propagation of Radio Waves* A college textbook (Moscow: Goryachaya Liniya–Telekom, 2002) 560 pp. ISBN 5-93517-073-6.

The systematic and detailed coverage of this text includes the basic equations and principles of electrodynamics, the excitation of electromagnetic (EM) fields in an unbounded uniform medium, the theory of guiding systems, boundary value problems concerning the excitation or the existence of EM waves in guiding systems and in cavity resonators, and wave scattering and diffraction phenomena involved in applied radio-engineering problems. Also presented are the fundamentals of geometrical optics and an introduction to nonlinear media and EM propagation in nonuniform and anisotropic media. The effects of the Earth surface, troposphere and ionosphere on the propagation of EM waves at various frequencies are also discussed. Particular attention is given to the physical interpretation of electromagnetic phenomena. Along with over 350 illustrations, the example calculations and formulations of 132 test problems are

included in the text. (Goryachaya Liniya–Telekom Publ. contact information: tel./fax: (7-095) 287-49 56; e-mail: radios_HL@mtu-net.ru)

Dimitrienko Yu I *Tensor Calculus* (Moscow: Vysshaya Shkola, 2001) 575 pp. ISBN 5-06-004155-7.

This textbook covers those branches of tensor calculus which are used in the mechanics and electrodynamics of continua, composite mechanics, crystal physics, and quantum chemistry, namely: tensor algebra, tensor analysis, the tensor description of curves and surfaces, and the fundamentals of tensor integral calculus. Topics include the theory of invariants, the theory of indifferent tensors used to describe the physical properties of media, the theory of anisotropic tensor functions, and the fundamentals of tensor calculus in Riemannian and affinely connected spaces. For undergraduates and postgraduates in physics, mathematics, and mechanical engineering disciplines. (Vysshaya Shkola Publ.: 127994 Moscow, ul. Neglinnaya 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/>)

Vlasova E A *The Series* (“Mathematics in a Technical College” Series, issue No. 9) (Moscow: N É Baumann MGTU Publ., 2002) 612 pp. ISBN 5-7038-1392-1.

The ninth issue of the “Mathematics in a Technical College” series acquaints the reader with the basic concepts of the theory of numerical and functional series. This book covers power series, Taylor series, trigonometric Fourier series and their applications, and Fourier integrals. The theory of series in Banach and Hilbert spaces is presented and, at a level necessary for its study, functional analysis and the theory of the Lebesgue measure and the Lebesgue integral are introduced. Theoretical material is accompanied by minutely examples, figures, and many problems of varying levels of difficulty. The content of the textbook corresponds to the author’s lecture course at the N É Baumann MGTU. For technical college students, teachers, and postgraduates. (N É Baumann MGTU Publ.: 107005 Moscow, 2-ya Baumanskaya ul. 5; tel.: (7-095) 263-60 45; fax: (7-095) 265-42 98; e-mail: press@bmstu.ru; URL: <http://www.press.bmstu.ru>)

Ventzel’ E S *Problems and Exercises in Probability Theory* A textbook (Moscow: Vysshaya Shkola, 2002) 447 pp. ISBN 5-06-004221-9.

This collection presents a systematized selection of problems and exercises in probability theory. All the problems are provided with answers, and most also with solutions. At the beginning of each chapter, theoretical basics and formulas necessary for solving the problems are given. The book is intended for students in technical colleges and should also be useful to teachers, engineers and researchers engaged in mastering probability methods for solving practical problems. (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/>)

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