

New books on physics and related sciences

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Bokhan P A, Buchanov V V, Zakrevskii D É, Kazaryan M A, Kalugin M M, Prokhorov A M, Fateev N V *Laser Isotope Separation in Atomic Vapors* (Moscow: Fizmatlit, 2004) 208 pp. ISBN 5-9221-0497-7.

Various approaches to laser isotope separation in atomic vapors are explored. Photoionization and photochemical techniques using the coherent isotope-selective two-photon excitation of atoms are reviewed for both collinear and counterpropagating radiation beams. Detailed numerical simulations of such processes are performed. The method aimed at obtaining isotopically modified species with the use of reactions of atoms selectively excited to long-lived states is proposed. The laser isotope separation system and its individual elements are given special attention in this book intended for research workers, engineers, as well as undergraduate and postgraduate students. (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/>)

Zaitsev R O *Diagram Techniques in the Theory of Superconductivity and Ferromagnetism* (Moscow: Editorial URSS, 2004) 176 pp. ISBN 5-354-00751-8.

This book describes diagram techniques for X-operators. Using this approach, the features of kinematic interaction in metals with strong intra-atomic correlations are examined. Conditions are found for which a Cooper instability corresponding to the nonphonon mechanism of high-temperature superconductivity results from the kinematic interaction. A similar discussion is given of the mechanism which produces the ferromagnetic instability of high-spin states and which explains the anomalous magnetic properties of transition metals. The book is intended for research workers and undergraduates and postgraduates 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/>)

Sarzhveskii A M *Optics: A Complete Course* 2nd ed. (Moscow: Editorial URSS, 2004) 608 pp. ISBN 5-354-00777-1.

Covering virtually all aspects of the training program and sticking to the classical course-presentation approach, the author avoids being heavily reliant on attendant mathematics and, whenever possible and expedient, tries to manage with simple mathematical tools — without, however, violating the logical structure of a particular physical theory or turning the course of experimental optics into a theoretical one. Along

with the program material, extensive coverage of applied optics problems is provided. The book is recommended for undergraduate students in physics-related disciplines at universities and engineering and technology higher education institutions. It can be used as a textbook on ‘Optics’ discipline. (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/>)

Roazanov V B, Stepanov R V *Concepts of Modern Science* What and Why Everyone Should Know about Physics. A manual (‘MIFI Economics-Analytical Institute Reader’ Series, Ed. by V V Kharitonov) (Moscow: Izd. MIFI, 2003) 232 pp. ISBN 5-7262-0500-6.

The main branches of physics and some of its current problems are examined in a concise and engaging way in this book, which also includes historical aspects and an analysis of how the science of physics affects the development of society and economy and, in broader terms, of the modern high-tech world. Exercises, problems, and review tests for each section are included. Although intended for the students of the Economics-Analytical Institute affiliated with the Moscow Engineering Physics Institute, the book will also be of interest to students and faculty in many other MPhI departments. (Internetshop Fizmatkniga: <http://www.fizmatkniga.ru>)

Nanotechnologies in Semiconductor Electronics (Ed.-in-Chief A L Aseev) (Novosibirsk: Izd. SO RAN, 2004) 368 pp. ISBN 5-7692-0680-2.

The monograph examines the contribution of the SB RAS Institute of Semiconductor Physics, Novosibirsk to nanotechnology and diagnostics research aimed at developing new-generation micro- and nanoelectronics devices and instruments. Topics covered include molecular beam epitaxy technology; nanostructuring techniques for producing two- and three-dimensional nanostructures of various shapes and geometries; current atomic-resolution diagnostics of semiconducting nanostructures, and the application of nanotechnologies to manufacturing nanoelectronics devices. This monograph will serve as an invaluable reference source for specialists in semiconductor physics, the physics and chemistry of solids, micro- and nanoelectronics, and nanotechnology. (SB RAS Publ.: 630090 p/b 187, Novosibirsk, Morskoï prosp. 2; e-mail: sprice@as-sbras.nsc.ru; URL: <http://www-psb.ad-sbras.nsc.ru/>)

Sobolev S L *Selected Works* Vol. 1 *Equations of Mathematical Physics. Computational Mathematics and Cubature Formulas* (Novosibirsk: Izd. Inst. Matematiki, Geo Branch of the SB RAS Publ. House, 2003) 692 pp. ISBN 5-86134-118-4.

This is the first volume of the selected works of the prominent mathematician S L Sobolev — Full Member of the USSR AS.

The content of the volume is the Academician's works on the equations of mathematical physics, computational mathematics, and the theory of cubature formulas — works through which his scientific ideas, approaches, and methods reverberated. The works published here are the ones that laid the foundation of and served as a source of intense development for the modern theory of partial differential equations and equations of mathematical physics, as well as for new directions in functional analysis and computational mathematics. Russian translations of some of Sobolev's foreign language publications are also provided. Specialists and postgraduate and senior undergraduate students in mathematics and mechanics are the target audience of the book. (Geo Branch of the SB RAS Publ. House: 630090 Novosibirsk, prosp. akad. Koptyuga 3; tel./fax (7-3832) 34-29-08; e-mail: spc@uiggm.nsc.ru; URL: <http://www.izdatgeo.ru/>)

Blokhin A M, Trakhinin Yu L *Stability of Strong Discontinuities in Magnetic Hydrodynamics and Electrohydrodynamics* (Moscow: Institute for Computer Studies, 2004) 324 pp. ISBN 5-93972-357-8.

This monograph examines in detail the multidimensional stability of strong discontinuities (in particular, of shock waves) for systems obeying the conservation laws and presents the authors' results for the mathematical models of ideal magnetic hydrodynamics (classical, relativistic, and pressure-anisotropic) and electrohydrodynamics. The major emphasis is on the analysis of linearized stability, especially on the question of uniform stability in the sense of satisfying the Lopatinskii steady condition for the linearized problem. The extension of results for linear uniform stability to the original nonlinear level is examined. Detailed discussion is given on each major stage of the so-called 'equational' approach, which the authors choose to treat the stability of the surfaces of strong discontinuities in the mechanics of continua. The idea of the approach is to subject the stability problem to a rigorous mathematical analysis in terms of the theory of partial differential equations, primarily by using the method of dissipative energy integrals to obtain *a priori* estimates without a loss of smoothness. The intended audience includes specialists in applied mathematics, mechanics of continua, and mathematical physics. (Institute for Computer Studies Publ.: 426034 Izhevsk, ul. Universitetskaya 1; tel./fax (7-3412) 50-02-95; e-mail: borisov@ics.org.ru; URL: <http://www.ics.org.ru/>)

Ketsaris A A *Algebraic Foundations of Physics. Space-Time and Action as Universal Algebras* ('Relata Refero' Series) 2nd ed. (Moscow: Editorial URSS, 2004) 280 pp. ISBN 5-354-00761-5.

The subject of this monograph is a unified theory of interactions, which involves the passage from the four-dimensional space-time to the space of tensors of all ranks and in which the multidimensional generalization of Lagrange's principle of least action is employed. The methods of algebra and differential geometry, including Cartan's method of differential forms, are used and most of the calculations are worked out in detail in this book aimed at specialists, faculty, and students in theoretical physics and 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, 135-42-46; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Synergetics and Control Problems (Ed. by A A Kolesnikov) (Moscow: Fizmatlit, 2004) 504 pp. ISBN 5-9221-0336-9.

A new synergetic approach to synthesizing the control systems of nonlinear multidimensional dynamic objects of various nature is developed based on natural homeostasis — the term referring to the conservation of the desired inner properties of a dynamic system. Introducing invariants (synergies) into control theory as its basic elements imparts natural-mathematical unity to the theory, unifying it conceptually as well as methodologically. Invariants in this context are the basic language of science, determining the systems aspects of the control theory and linking it directly to the fundamental principles of modern natural science, with which actual motions can be selected from the set of possible ones by means of invariant relations representing problem-relevant conservation laws. The book is intended mainly for researchers, postgraduate students, and engineers specializing in the modern control theory of dynamic objects of various physical (chemical, biological, economic) nature. (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/>)

Boss V *Lectures on Mathematics: Analysis* (Moscow: Editorial URSS, 2004) 216 pp. ISBN 5-354-00773-9.

Written in a concise, transparent, and, indeed, sometimes back-of-the-envelope manner, this book places much emphasis on motivation for results and on large-scale vision. The first part covers vast material from standard courses in mathematical analysis. In the second, optional part analysis-related subjects such as analytical functions, topology and fixed points, and vector analysis are presented in a review or an essay style. 'Lofty matters' are presented at an accessible level in this easy-to-read book intended for students, faculty, engineers, and research workers alike. (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/>)

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