

New books on physics and related sciences

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Gorbunov D S, Rubakov V A *Introduction to the Theory of the Early Universe: Cosmological Perturbations, Inflation Theory* (Moscow: URSS–LKI, 2010) 568 p. ISBN 978-5-396-00046-9.

This book has been largely written in the context of the linkage between cosmology and the physics of the microscopic world. It presents results concerning the theory of evolution of cosmological perturbations, inflation theory, and the theory of postinflation heating. The book is a sequel to the volume *Introduction to the Theory of the Early Universe: Theory of the Hot Big Bang* (Moscow: URSS, 2008), which presented the results characterizing the uniform isotropic Universe at the hot stage of its evolution and at subsequent cosmological stages. This book treats both the established concepts of the early and contemporary Universe and theoretical models that have not yet found experimental confirmation. Some chapters operate with methods of non-equilibrium statistical physics and more special methods of quantum field theory. To facilitate the reading of these chapters, necessary information is provided in the Appendices. The book is intended for researchers, postgraduates, and students who major in elementary particle physics and cosmology. (URSS Publishing House: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Systems Analysis Institute; tel./fax (7-499) 135-44-23; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Okun L B *Primer in Particle Physics* 3rd ed. (Moscow: Fizmatlit, 2009) 128 pp. ISBN 978-5-9221-1070-9.

The book provides a popular description of the current status and prospects of elementary particle physics. The reader becomes acquainted with the main fundamental particles — leptons, quarks, photons, gluons, and W- and Z-bosons. As the story unfolds, certain fundamental concepts of the theory of relativity, quantum mechanics, and quantum field theory are introduced, since without them it would be impossible to draw the correct picture of the essence of the fundamental phenomena that take place in interactions between elementary particles. The book is intended mainly for students of senior classes of high schools, and university students and teachers. (FIZMATLIT Publishing Company: 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/>)

Fock V A *Problems in Diffraction and Propagation of Electromagnetic Waves* 3rd ed. (Moscow: URSS–LKI, 2010) 520 pp. ISBN 978-5-382-01133-2.

The present volume is a collection of original papers of the outstanding Russian physicist V A Fock (1898–1974). The first part of the monograph elaborates the asymptotic theory of diffraction based on the principle of local field (established by V A Fock) in the penumbral zone on the surface of a well-conducting convex body. Papers of the second part treat problems in around-the-globe propagation of radio waves in uniform and nonuniform (layered) atmospheres, taking diffraction into account. The mathematical appendix develops the theory of integral equations discussed in the main text and gives tables of Airy functions and auxiliary functions used to compute current distributions. This book was published in 1965 in English as Volume 1 of a series of monographs published in accordance with the decision of the International Editorial Board: Fock V A *Electromagnetic Diffraction and Propagation Problems* (International Series of Monographs in Electromagnetic Waves, Vol. 1) (London: Pergamon Press, 1965). The present Russian edition is an expanded collection (in comparison with that in English) of Fock's papers on the subject. The monograph will be of interest and value to a broad spectrum of physics theoreticians, geophysicists, communications specialists, students and postgraduates in natural sciences, and also those seeking technician qualification at educational establishments. (URSS Publishing House: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Systems Analysis Institute; tel./fax (7-499) 135-44-23; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Izyumov Yu A, Kurmaev E Z *High-Temperature FeAs-Based Superconductors* 2nd ed., revised and enlarged (Moscow–Izhevsk: RKhD, 2010) 336 pp. ISBN 978-5-93972-805-8.

Analysis is given of the physical properties and electron models of the new class of high-temperature superconductors in layered iron-based compounds. Despite differences in chemical composition and crystal structure, they have similar physical properties due to electron carriers in FeAs-layers and their interaction with magnetic order fluctuations. They have caused exceptional interest because of the possible promise of practical applications. The monograph gives a complete picture of formation of their physical properties on the basis of theoretical models and known electronic structure. This book will be useful for a broad range of readers: physicists working on the electronic properties of FeAs-based materials, chemistry investigators synthesizing these compounds, and specialists doing computation of the electronic structure of solids. It will be of interest not only to researchers working in superconductivity and magnetism but also to students, postgraduates, and anyone wanting an introduction into

this vibrant field of physical materials science. ('Regular and Chaotic Dynamics' Scientific Publishing Center; 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95; e-mail: subscribe@rcd.ru; URL: <http://shop.rcd.ru/>)

Ivanov V A, Rabinovich A L, Khokhlov A R (Exec. Ed.) *Methods of Computer-Assisted Modeling for the Study of Polymers and Biopolymers* (Moscow: URSS–Librokom, 2009) 696 pp. ISBN 978-5-397-01119-8. RFBR projects 08-03-07031-d, and 09-03-02002-e_d.

This book guides the reader into the world of the topical problems and main avenues of research in the field of computer-assisted modeling of polymers and biopolymer systems, including nanomaterials and nanocrystals. It offers a description of the main methods and algorithms of computerized modeling and gives a general review of their evolution. Much attention is focused on presenting the general principles of the realization of the complete program of so-called multiscale modeling. Modeling techniques on different (microscopic, mesoscopic, and macroscopic) spatial and temporal scales are discussed: quantum-chemical techniques, atomic and coarse molecular dynamics, Monte Carlo method, stochastic dynamics, field-theoretical methods for the self-consistent mean field, density functional, nonlinear integral equations of the theory of liquids, phenomenological methods of solving equations in continuous media, semi-empirical methods of calculating the physical properties of polymers starting with the contributions of individual atoms and/or groups of atoms, etc. Examples are given of studying the properties of various molecular systems via a computer experiment. This book will be particularly welcomed by specialists in the physics and chemistry of molecular systems, including polymers and biopolymers, who apply methods of computer-assisted modeling in their work, and also for undergraduate students and postgraduates—physicists, chemists, biologists—who specialize in the corresponding fields of knowledge; this text may be used for getting acquainted with this area of research as well as a source of reference information. (URSS Publishing House: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Systems Analysis Institute; tel./fax (7-499) 135-44-23; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Kolesnichenko A V, Marov M Ya *Turbulence and Self-Organization: Problems in Modeling of Cosmic and Terrestrial Systems* (Moscow: BINOM–Laboratoriya znanii, 2009) 632 pp. ISBN 978-5-94774-899-4. RFBR project 08-01-07033.

This monograph discusses a number of complex problems currently facing geophysics and astrophysics in terms of the methods of mechanics of continuous media; it uses the stochastic–thermodynamic approach (suggested by the authors) to constructing semiempirical models of well-developed turbulence in reacting multicomponent and electrically conducting gases, in gas–dust media, and in uniform liquids when nonlinear cooperative processes in the liquid are taken into account. This approach promises efficient employment of the constructed continual models for solving specific hydrodynamic problems connected with studying peculiar features of natural integrated systems and cosmic media, and with the reconstruction and prediction of

their evolution. The main focus of the book is on developing models of turbulent hydrodynamic systems with complicated physicochemical characteristics that lie at the basis of problem formulations and numerical calculations of the problems covering formation, structure, and evolution of various astro- and geophysical objects. Among them are various models of turbulent flow of multicomponent and heterogeneous mixtures, taking into account processes of diffusion, heat transfer, viscosity and emission of radiation, models of turbulent motions in chemically active gases and gas suspensions with phase transformations, models of structured turbulent flows of uniform liquid and flows interacting with an electromagnetic field, and models that take into account the effect of hydrodynamic helicity on the evolution of turbulence in a revolving system. This traditional area of research offers numerous academic and engineering applications; suffice it to mention among them progress in the understanding of the origin and evolution of Earth and the planets of the Solar System, the formation of accretion disks, the study of turbulent heat and mass transfer processes in rarefied gas envelopes of cosmic bodies, and the development of spacecraft and new generations of power engines. In addition, the monograph discusses the currently important theory of self-organization under irreversible processes and the problem of structure formation in various natural complexes, most of all in well-developed turbulent flows, which is a reflection of a general concept of stochastic dynamics connected with the emergence of ordered structures when the departure from equilibrium is considerable. The problem of creation and evolution of coherent vortical systems in turbulent flows are treated by the authors on the basis of an analysis of the relationship between order and chaos in open dissipative systems from the standpoint of the stochastic nonlinear thermodynamics of irreversible processes. This concept is used, in particular, to simulate the structure and evolution of a protoplanetary gas–dust disk whose turbulent nature facilitates the formation of primary dust clusters inside. The authors deliberately lengthened the list of instances of self-organizing dynamic systems by expanding it to include the observable specific features of numerous cosmological structures and their evolution, even though they knew well that the understanding of the process of structure formation in such a multifaceted phenomenon may be rather subjective and not acceptable to other investigators of natural and cosmic media. At the same time, this kind of discussion of a set of questions concerning the nature of the surrounding world takes us far beyond the narrow problems of modeling structured turbulence (to which the main body of the monograph is in fact dedicated), and serves to reflect the generality of the concept of formation of highly organized nonequilibrium structures in natural and cosmic media and to attract the attention of researchers to this range of problems. The book will serve as a useful reference source for researchers working in astrophysics, geophysics, planetology, aeronomy, and space research, as well as senior-year students and postgraduates majoring in the appropriate fields. (BINOM–Laboratoriya Znaniy Publishing House: 125167 Moscow, proezd Aeroporta 3; tel. (7-499) 157-52-72; e-mail: binom@lbz.ru; URL: <http://www.lbz.ru/>)

Nobel Lectures on Physics Vol. 2 1995–2004 (Moscow–Izhevsk: RKhD–Institute of Computer Studies, 2009) 796 pp. ISBN 978-5-93972-738-9.

This is the second volume presenting a collection of lectures delivered by Nobel Prize winners in Physics, 1995–2004, with additional biographical and historical information. It includes the classical lectures of 't Hooft, D Gross, Zh I Alferov, V L Ginzburg and some others, which at some point were published in various issues of *Physics–Uspekhi* journal but were never published together in full. This volume makes it possible to trace the inner dynamics of the evolution of science over a decade and to get outstanding ideas from the original source, and to see how the greatest discoveries were born. The book will be useful for a broad range of specialists, students, and postgraduates, as well as for science historians. The volume is accompanied with a CD containing full-color versions of figures in the lectures. ('Regular and Chaotic Dynamics' Scientific Publishing Center: 426034 Izhevsk, ul. Universitetskaya 1; tel. (7-3412) 50-02-95; e-mail: subscribe@rcd.ru; URL: <http://shop.rcd.ru/>)

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Bittencourt J A *Fundamentals of Plasma Physics* (Translated from English, general ed. L M Zelenyi; ed. of translation A M Sadovskii) (Moscow: Fizmatlit, 2009) 584 pp. ISBN 978-5-9221-1169-0.

This book by Professor J Bittencourt of the Institute of Space Research in San Jose, Brazil covers the fundamentals of plasma physics and its well-established concepts and results. Plasma-wave phenomena are treated on the basis of an explicit kinetic description. All necessary additional information from hydrodynamics and kinetic theory are included in the text. This volume is a translation of the earlier published volume: Bittencourt J A *Fundamentals of Plasma Physics* (Berlin: Springer, 2004). The book is intended for specialists, senior-year students and postgraduates who have begun studying the new field. (FIZMATLIT Publishing Company: 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/>)

Loshak G *Science and the Shadow* (Translated from French by A I Pigalev; eds of translation L I Urutskoev, G Loshak) (Moscow–Izhevsk: RKhD, 2009) 264 pp. ISBN 978-5-93972-736-5.

This book is a product of the great love that the well-known physics theorist G Loshak feels toward science; it is an attempt to rethink the role of science in contemporary civilization. The author shares with us on the pages of this book his anxiety for the future of science as such, as it is changing and resembling technology more and more. To characterize the current science–technology interplay, the author metaphorically compares it with the well-known Hans Andersen's classic tale "The scientist and the shadow". The future will show if these misgivings prove prophetic. At the moment we can certainly agree that there is a basis to them. This book is profoundly an open debate and the reader may reject some of the author's convictions. This is excellent, of course, since readers will be stimulated to reason it out for themselves. The times when everyone in our country was obliged to think exactly like everyone else is behind us and luckily the new times are still with us. The author put a fair share of irony and sometimes sarcasm into it; merged with brilliant literary style, this makes the book an absorbing and captivating read. ('Regular and Chaotic Dynamics' Scientific