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New books on physics and related sciences

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Fortov V E ***Extreme States of Matter on the Earth and in Space*** (Moscow: Fizmatlit, 2008) 312 pp. ISBN 5-9221-0963-5.

The book describes the physical properties of matter and numerous processes densities occurring in nature at ultimately high energy densities that correspond to extreme temperatures and pressures. The book evolved from the lectures delivered by the author at the Moscow Institute of Physics and Technology and is based on Fortov's various surveys and invited reports from conferences and symposia. An attempt was made to systematize, generalize, and present the theoretical and experimental material belonging to a new field of physics, the physics of extreme states of matter, viewed from a common standpoint. The book is intended to be of use for a broad range of scientists and postgraduates engaged in the natural sciences; it opens to them a path to relevant publications and allows them to find their way among the exciting problems of modern physics. The book was recommended by the Joint Education and Methodology Group of Higher Education Establishments of the Russian Federation for teaching applied mathematics and physics (Fiziko-Matematicheskaya Literatura Publ. MAIK 'Nauka/Interperiodika': 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/)

Ebeling W, Ferster A, Fortov V, Gryaznov V, Polishchuk A ***Thermophysical Properties of Hot Dense Plasma*** (Moscow – Izhevsk: RKhD, Institute for Computer Sciences, 2008) 408 pp. ISBN 978-5-93972-646-7.

This book deals with high-density plasma in which the energy of interaction between particles is comparable to the kinetic energy of their thermal motion. The main focus is on the methods of calculation of thermodynamic functions of equilibrium systems. The presentation touches on the kinetic properties of nonideal plasmas and on the problems connected with the absorption of laser radiation and with the deceleration of heavy ion beams in plasmas with strong interparticle interaction. Theoretical methods and models for describing dense plasmas are discussed and the results obtained are compared with available experimental data. (Scientific and Publishing Center 'Regular and Chaotic Dynamics': 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95, (7-495) 332-48-92; e-mail: subscribe@rcd.ru; URL: http://shop.rcd.ru/)

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Translated by V I Kisin

Khriplovich I B ***Theoretical Kaleidoscope*** (Moscow – Izhevsk: RKhD, 2007) 116 pp. ISBN 978-5-93972- 509-5.

The book is based on the lectures delivered by the author for a number of years to students of Novosibirsk State University on supplementary chapters of theoretical physics. The book will be useful and clear to students and master-course undergraduates of physics departments and will be of interest to experienced physicists as well. The book contains the following chapters:
1. Classical mechanics. Unexpected facets.
2. Wave phenomena and classical electrodynamics without computations.
3. Atomic physics. A minimum of calculations.
4. Deuteron – the hydrogen atom in nuclear physics.
5. Quasiclassical approximation in a complex plane.
6. Quantum electrodynamics.
Here again a minimum of calculations was admitted. (Scientific and Publishing Center 'Regular and Chaotic Dynamics': 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95, (7-495) 332-48-92; e-mail: subscribe@rcd.ru; URL: http://shop.rcd.ru/)

Frank-Kamenetskii D A ***Lectures on Plasma Physics*** 3rd ed. (Dolgoprudnyi: Izd-vo Intellekt, 2008) 280 pp. ISBN 978-5-91559-002-0.

The fundamental concepts of plasma physics and the elementary engineering physics calculations are presented. The thermodynamic properties of plasmas; equilibrium and stationary ionization; adiabatic and drift motion of charged particles; elementary hydrodynamic theory of wave propagation in cold and hot plasmas, and the simplest aspects of physical kinetics and its application to plasma are treated in detail. The book will be equally valuable to students specializing in physical and technical subjects and engineers dealing with diverse applications of plasma physics. (Intellect Publ.: 141700 Dolgoprudnyi, Moscow region, Promyshlennyi proezd 14; tel. (7-495) 408-76-81; e-mail: lfs@id-intellect.ru; URL: http://www.id-intellect.ru/)

Selishchev P A ***Self-Organization in Radiation Physics*** (Moscow – Izhevsk: RKhD, Institute for Computer Sciences, 2008) 208 pp. ISBN 978-5-93972-576-7.

The monograph analyzes the role played by nonlinear interrelations between elements of the structure of radiation-damaged irradiated crystal in the self-organization of the structure and the effects produced by fluctuations of the rate of displacement creation and the random distribution of point defect sinks on this process. It also treats the formation of the nonuniform distribution of radiation defects in response to elastic interaction between them, and manifestations of such formation in the concentration layering of irradiated alloys and in accelerating the process of oxygen precipitation in silicon; the development of self-oscillations of

temperature in irradiated samples and of the density of radiation defects, and the dynamics of porosity and creep variations in irradiated materials. It is shown that nonlinear interrelations determine the form and parameters of the emerging structure of radiation defects and of the stationary regime of defect accumulation. The influence of fluctuations of irradiation conditions manifests itself especially sharply in the dynamical behavior of systems: the threshold of instability development shifts, and new areas of instability and dynamic behavior with no deterministic analogs develop. The monograph should appeal to research workers and experts in radiation physics and radiation study of materials, to everyone interested in synergetics and self-organization processes in open nonequilibrium systems, and to postgraduate and undergraduate students of physics in higher education establishments. (Scientific and Publishing Center 'Regular and Chaotic Dynamics': 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95, (7-495) 332-48-92; e-mail: subscribe@rcd.ru; URL: http://shop.rcd.ru/)

Kryukov P G ***Femtosecond Pulses: Introduction to the Novel Area of Laser Physics*** (Moscow: Fizmatlit, 2008) 208 pp. ISBN 5-9221-0941-3.

The book is devoted to one of the most important and pressing fields in modern laser physics — the generation of ultrashort pulses of laser radiation. A brief history of the research that led to the creation of the radically new source of light — the laser — is outlined. The principles of laser operation that make it possible to generate pulses of femtosecond duration and amplify their power to the petawatt level are discussed. It is explained how the duration of such short pulses is measured. Examples are given of the most impressive cases of application in the field of academic research, in technology and medical sciences, which are based both on the ultimately short length of laser pulses and on the ultrahigh intensity of laser radiation. Thus, the newest application of femtosecond lasers is discussed, which involves precision measurements of optical frequencies and the possibility of creating ultra-accurate and compact optical clocks based on them. The book is intended for students, postgraduates, and all those interested in the problems of modern laser physics and their applications in nanotechnologies. (Fiziko-Matematicheskaya Literatura Publ. MAIK 'Nauka/ Interperiodika': 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/)

Gordienko V A ***Vector-Phase Methods in Acoustics*** (Moscow: Fizmatlit, 2007) 480 pp. ISBN 5-9221-0864-5.

One of the most interesting approaches to recording acoustic fields, known in Russia as 'vector-phase methods', is presented for the first time consistently and in a manner accessible to the reader unacquainted with the topical problems of hydroacoustics. This approach is made at a sufficiently high scientific level. The text of the monograph constitutes an expanded version of the course of lectures delivered by the author at the Physics Department of Moscow State University. The book is intended for students, postgraduates, and specialists who wish to receive a sufficiently complete picture of the potential of vector-phase methods for solving the most varied acoustic problems: detection of weak signal sources against a noisy background, problems of bioacoustics and ecology, and earthquake forecasting. (Fiziko-Matematicheskaya Literatura Publ. MAIK 'Nauka/Interperiodika': 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/)

Bazhenov V G, Igumnov L A ***Methods of Boundary Integral Equations and Boundary Elements in Solving Problems of the Three-Dimensional Dynamic Theory of Elasticity with Conjugate Fields*** (Moscow: Fizmatlit, 2008) 344 pp. ISBN 5-9221-0953-7.

This monograph gives a consistent presentation of the novel numerical – analytical method for solving dynamic problems in the mechanics of deformable solids. Presented in detail is the direct version of the method of boundary integral equations with the boundary elements technique of numerical modeling. A nonclassical scheme of reducing boundary problems to new boundary integral equations is introduced as a way to overcoming the problem of inefficiency in applying the methods of boundary integral equations and boundary elements to three-dimensional dynamic problems of anisotropic elasticity theory and its extended versions. The resulting boundary integral equations are exact, in contrast to all other currently known schemes in which the final boundary integral equations are approximate. The scheme is extended to boundary problems of the dynamic mechanics of deformable solid bodies with conjugate fields. The efficiency of this nonclassical approach is demonstrated by solving a number of three-dimensional dynamic problems for isotropic bodies. The book is designed primarily for research workers, postgraduates, and students who major in the theory and numerical methods of solving three-dimensional dynamic problems of the mechanics of deformable solid bodies. (Fiziko-Matematicheskaya Literatura Publ. MAIK 'Nauka/ Interperiodika': 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/)

Churilov G N, Bulina N V, Fedorov A S ***Fullerenes: Synthesis and the Theory of Formation*** (Novosibirsk: Izd-vo SO RAN, 2007) 230 pp. ISBN 978-5-7692-0957-4.

This monograph generalizes the results of theoretical and experimental studies of fullerenes carried out over the last 20 years. Properties of fullerenes are given, plus the main fields of their applications and the methods of analysis used to study fullerene structures. Advantages and shortcomings of the main techniques of synthesizing fullerenes are shown. The results of studying the plasma in which fullerenes form are also reviewed. Special attention is paid to the theory of fullerene formation. A number of models covering fullerene formation are discussed. The experimentally established regularities and mechanisms of formation of carbon clusters and fullerene molecules provide the basis for an original theoretical model of fullerene formation described in the book. It is shown that the calculations of fullerene formation rates done in the framework of this theory, which takes into account the parameters of the plasma — its temperature and electron concentration, the effects due to changes in temperature of carbon clusters, and their cooling by the buffer gas —

are in good agreement with available experimental results. The material will be suitable as a textbook for research workers, teachers, postgraduates, and students engaged in both theoretical and experimental investigations of fullerenes and fullerene-based compounds. (RAS Siberian Branch Publ.: 630090, P.O.Box 187, Novosibirsk, Morskoi pr. 2; tel. (7-3832) 30-84-66; fax: (7-3832) 33-37-55; URL: http://www.sibran.ru/)

Mironov A V ***Fundamentals of Astrophotometry: Practical Basics of Stellar Photometry and Spectrophotometry*** (Moscow: Fizmatlit, 2008) 260 pp. ISBN 5-9221-0935-9.

The book presents the fundamentals of stellar photometry and spectrophotometry. The author considers the main types of radiation detectors utilized in astronomy and the effects of terrestrial atmosphere on the transmission of radiation. Energy distributions in the spectra of stars of basic spectral classes and the most important multicolor photometric systems are discussed. Methods of conducting astrophotometric observations and processing their results are presented. The book is aimed at astronomers and astrophysicists, postgraduates, and senior-year students of relevant specialties, as well as practising physicists interested in the methods of stellar photometry and stellar spectra. (Fizika-Matematicheskaya Literatura Publ. MAIK 'Nauka/Interperiodika': 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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