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New books on physics and related sciences

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Varlamov A A, Larkin A I *Theory of Fluctuations in Superconductors* Monograph (Moscow: Knizhnyi dom Universitet, 2007) 557 pp. ISBN 978-5-98227-243-0.

The monograph written by physics theorists A A Varlamov and A I Larkin can be used both as an encyclopedia and as a textbook on the theory of fluctuation phenomena in superconductors. The first half of the volume deals with a detailed description of phenomenological methods in the Ginzburg-Landau theory and of microscopic methods of quantum field theory when applied to describing fluctuations. In the second half of the book, the authors present a broad picture of manifestations of superconducting fluctuations in various observable quantities and of the role they play in such important fields as high-temperature superconductivity, Josephson structures, superconducting nanoscale objects, granulated superconductors, and strongly disordered systems. Most of the available textbooks create an impression that the BCS theory of superconductivity is an exact one. This misconception is not shared by the presented textbook: it clearly outlines the validity ranges of the mean field theory and describes a wide circle of phenomena that fall beyond these ranges. The book is aimed at physics researchers, postgraduates, and senior-year students of universities. (Knizhnyi dom Universitet Publ.: 119992 Moscow, Vorob'evy gory 1, bldg 6, NIIYaF, korp. 20, room 18; tel. (7-495) 939-40-36, 939-34-93; e-mail: kdu@kdu.ru; URL: http://www.kdu.ru/)

Arnol'd V I *Theory of Catastrophes* (Series 'Synergy: from past to future') 5th ed. (Moscow: Editorial URSS, 2007) 136 pp. ISBN 978-5-354-01142-1.

A mathematical description of catastrophes, namely, stepwise changes that arise when a system suddenly responds to a smooth variation of external conditions, is provided by the theory of singularities and the theory of bifurcations. Their applications to specific problems in various fields in science led to numerous controversies. The book clarifies what the theory of catastrophes really is and why it leads to heated debates. The results yielded by the mathematical theories of singularities and bifurcations are presented. This new edition is complemented with a review of the latest achievements of the theory of restructuring, a bibliography, and a problems section. The book is aimed at research workers, teachers, students, and anyone interested in modern mathematics. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute of System Analysis; tel./fax (7-495) 135-44-23, 135-42-16; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Uspekhi Fizicheskikh Nauk **177** (9) 1031–1032 (2007) Translated by V I Kisin Khrustalev O A, Timofeevskaya O D *Lectures on Quantum Mechanics* (Moscow–Izhevsk: Institute of Computing Research–RKhD, 2007) 316 pp. ISBN 978-5-93972-607-8.

The book presents the fundamentals, the mathematical apparatus, and some select topics of nonrelativistic quantum mechanics. It will be useful to students and postgraduates of physics departments of universities, as well as to anyone interested in quantum mechanics. The book contains 26 lectures:

Lecture 1. Kinematic postulate of quantum mechanics.

Lecture 2. Quantization of energy. General scheme of calculating energy levels.

Lecture 3. Uncertainty relation.

Lecture 4. How allowed states of a system are determined in quantum mechanics?

Lecture 5. Geometrization of the quantum mechanics formalism.

Lecture 6. Quantum mechanics postulates translated into the language of geometry.

Lecture 7. Quantization of energy of some very simple systems.

Lecture 8. Spherically symmetric systems.

Lecture 9. Motion in a centrally symmetric field.

Lecture 10. Symmetry of the Coulomb potential.

Lecture 11. Fine and hyperfine structures of energy levels in the hydrogen atom.

Lecture 12. Motion in a magnetic field.

Lecture 13. Quasiclassical approximation.

Lecture 14. An electron in a periodic field.

Lecture 15. Perturbation theory.

Lecture 16. Irreducible tensors.

Lecture 17. Multiparticle systems.

Lecture 18. A statistical model of the atom.

Lecture 19. Atomic structure.

Lecture 20. Quantization of an electromagnetic field.

Lecture 21. The space of states of an electromagnetic field.

Lecture 22. General theory of transitions.

Lecture 23. Secondary quantization.

Lecture 24. Bogoliubov's variational principle.

Lecture 25. Scattering theory.

Lecture 26. Scattering of light by atoms.

(Science Publication 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/)

Kingsep A S, Lokshin G R, Ol'khov O A *A Course in General Physics: The Foundations of Physics* Textbook for higher education establishments. In two volumes: Vol. 1 *Mechanics. Electricity and Magnetism. Oscillations and Waves. Wave Optics* (Ed. A S Kingsep) 2nd rev. ed. (Moscow: Fizmatlit, 2007) 704 pp. ISBN 5-9221-0753-4.

Belonuchkin V E, Zaikin D A, Tsipenyuk Yu M A Course in General Physics: The Foundations of Physics Textbook for higher education establishments. In two volumes: Vol. 2 *Quantum and Statistical Physics. Thermodynamics* (Ed. Yu M Tsipenyuk) 2nd rev. ed. (Moscow: Fizmatlit, 2007) 608 pp. ISBN 5-9221-0754-2.

This course of general physics was prepared to meet the requirements of the bachelor program in technical specializations and won a contest of the Russian Federation Ministry of Education. The course is aimed at students of technical universities, who are engaged in studying an advanced course in physics, as well as at students of physics and mathematics departments of classical universities. The presentation is carried out at a modern level with a sufficiently high degree of formalism but the reader is not required to have mathematical training beyond that obtained in technical universities - all the necessary additional knowledge is incorporated directly into the course. Volume 2 contains quantum physics of the atom, the nucleus, and elementary particles, and also statistical physics and thermodynamics. The concluding section analyzes the evolution of our understanding from the classical to the quantum system of describing nature, and discusses the origin of the world around us and the behavior of matter under extreme conditions. The book is recommended by the Russian Federation Ministry of Education as a textbook for students of the higher education establishments and has the stamp of the Methodology in Education Association. (Published by Fiziko-matematicheskaya literatura 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/)

Atomic Structure of Semiconductor Systems (Ed.-in-Chief A L Aseev) (Novosibirsk: Izd. SO RAN, 2006) 292 pp. ISBN 5-7692-0841-4.

The volume presents the results obtained at the Institute of Physics of Semiconductors, SB RAS on studying the structure of semiconductor systems subjected to various technological actions. Described and characterized are the dislocation structure of semiconducting crystals and films, the atomic structure of point defect clusters in silicon and germanium, and atomic restructuring on stepped silicon surfaces. The data obtained are used in developing the technology of designing novel materials and devices of micro-, opto-, and nanoelectronics, as well as micro- and nanostructures for the study of quantum and one-electron effects. The concluding part of the volume is devoted to pressing problems in the development of semiconductor nanotechnologies based on the current achievements in the methods of molecular beam epitaxy, in creating silicon-on-insulator structures, and in nanolithography techniques. The book will be of interest to specialists in semiconductor materials science and semiconductor electronics researchers, engineers in the industry, and undergraduate students and postgraduates who train in relevant areas, including 'Nanomaterials' and 'Nanotechnologies in Electronics' disciplines. (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/)

Snarskii A A, Bezsudnov I V, Sevryukov V A Transport Processes in Macroscopically Disordered Media (Moscow: Editorial URSS, 2007) 304 pp. ISBN 978-5-382-00191-3.

This book deals with current problems of the physics of inhomogeneous bodies. The main task set out in this book is how to calculate their effective parameters, using knowledge about the distribution of ingredients in a composite: effective conductivity, dielectric and magnetic permeabilities, etc. The book focuses on further progress in the theory of macroscopically inhomogeneous media and covers a broad range of physical phenomena in composites. These are galvanoelectric, thermoelectric, and elastic properties of macroscopically disordered media, the 1/f noise and the higher current momenta, the generation of harmonics in composites in the vicinity of and at the very threshold of percolation, and so forth. The unification of approaches used in this book links together phenomena so dissimilar that seeing them mentioned side by side gives one a jolt, for instance, the 1/f noise in percolation media alongside Abrikosov's vortex pinning and Anderson's localization. The approach used in this book the hierarchical model — will allow the reader to see for himself and to understand through his own efforts, using only a limited number of sheets of paper, the main relations, numerical characteristics, and functional interrelations. The authors have presented the material in a way that is suitable for the reader who either has completed or is taking a university course in physics. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute of System Analysis; tel./fax (7-495) 135-44-23, 135-42-16; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Beletskii V V *Regular and Chaotic Motion of Solids* (Moscow–Izhevsk: Institute of Computing Research–RKhD, 2007) 132 pp. ISBN 978-5-93972-597-2.

The book discusses model problems in the dynamics of solids as applied to terrestrial and extraterrestrial bodies. Special attention is paid to the combination of regular and chaotic characteristics of motion. Described from this point of view are the dynamics of the body of a bipedal apparatus; problems of orientation and stabilization of artificial and natural celestial bodies, and the basics of the theory of dynamic billiards in the gravitational field. The last chapter of the book gives a brief review of the most important results obtained by the author during many years of work (since 1956) in the field of rotational motion of celestial bodies, including the generalized Cassini laws for resonance rotational motions of celestial bodies. The book contains a large number of figures that demonstrate a combination of regular and chaotic trajectories in the phase space. (Science Publication 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/)

Vatul'yan A O *Inverse Problems in the Mechanics of Deformable Bodies* (Moscow: Fizmatlit, 2007) 224 pp. ISBN 5-9221-0835-5.

Various classes of inverse problems in the mechanics of deformable solids are treated: retrospective, boundary, coefficient, and geometrical, in which coefficients of differential operators, initial conditions, boundary conditions, and the geometry of internal imperfections (cavities, cracks) are determined using certain additional experimentally obtained information. Presented are the formulation of problems, the basics of general approaches in the theory of inverse and illposed problems, peculiarities of iteration schemes and methods of regularization in solving specific inverse problems in the theories of elasticity, acoustics, viscoelasticity, electroelasticity, and heat conduction. Diagrams for the construction of operator equations with compact operators, together with methods of proving uniqueness theorems, are presented and various methods of construction of approximate solutions are suggested; numerical results obtained using regularization methods are also presented. The book is intended for research workers and engineers engaged in the mechanics of deformable bodies, numerical methods, defectometry, geophysics, and experimental mechanics, and at senior-year students and postgraduates majoring in 'Mechanics' and 'Applied mathematics' disciplines. (Publishing company Fiziko-matematicheskaya literatura 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/)

Frolov G I, Zhigalov V S Physical Properties and Applications of Magnetic Film Nanocomposites (Ed.-in-Chief V F Shabanov) (Novosibirsk: Izd. SO RAN, 2006) 188 pp. ISBN 5-7692-0855-4.

The creation of nonequilibrium structures in solids offers a way to design materials with novel properties. This monograph discusses possible implementations of this approach using as an illustration the case of magnetic film materials with cluster and nanocrystalline structures. Specifics are discussed of the structure and properties of amorphous ferrimagnet films of rare earth-transition metal alloys, of their possible application in the devices of optical data processing, and of problems of correlation of the structure and magnetic properties in nanocrystalline 3d-metal films; methods are described of manufacturing such materials with a grain size less than 10 nm. Finally, approaches are outlined for creating high-resistivity magnetically soft materials and data-carrier media for superhigh-density magnetic recording. The book is aimed at specialists in solid-state physics, physical chemistry, and materials science and at undergraduate students and postgraduates in the corresponding fields. (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/)

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