New books on physics and related sciences

Rubakov V A *Classical gauge fields. Boson theories* Part 1. 5th edition, revised and consid. suppl. (Moscow: URSS, 2020) 344 pp. ISBN 978-5-9710-7238-6.

The book is based on the lecture course delivered to third- and fourth-year students of the Physical Faculty of Moscow State University engaged in theoretical physics. The book consists of two parts, the first of which contains the main ideas of gauge field theory, the construction of gauge-invariant Lagrangians, and a description of the spectra of linear excitations, including those based on a nontrivial ground state. The presented material can be studied in parallel with quantum mechanics and then quantum field theory. The book was revised considerably with allowance for the lecture course delivered at the Chair of Particle Physics and Cosmology of the Faculty of Physics of Lomonosov Moscow State University. Along with clarification and extension of some sections, several new sections were added, as well as two supplements at the end. The book can be useful to both research workers and postgraduates, as well as to senior university students. (URSS Publishers: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru; URL: http://urss.ru/)

Isaev A P, Rubakov V A *Theory of groups and symmetries*: *finite groups. Lie groups and Lie algebras* (Moscow: Krasand/URSS, 2018) 504 pp. ISBN 978-5-396-00841-0.

This book extensively presents the basic points and results of the group and symmetry theory that are widely applied in theoretical and mathematical physics. The algebraic group theory and the theory of Lie group and Lie algebra representations are discussed. Special attention is paid to compact Lie groups and Lie algebras, and also to conformal groups and algebras in spaces of different dimensions. A classification of semisimple finite-dimensional Lie algebras is briefly considered. Yangians connected with simple Lie algebras of classical series are defined. The basic elements of differential geometry of homogeneous spaces are presented. The book is of interest to research workers, postgraduates, and senior students engaged in theoretical and mathematical physics.

Isaev A P, Rubakov V A *Theory of groups and symmetries*: *Representations of Lie groups and Lie algebras. Appendices* (Moscow: URSS 2020) in press.

The fundamentals of the theory of Lie group and Lie algebra representations are presented. Finite-dimensional complex representations of simple Lie algebras are classified on the basis of the weight theory. The theory of finite-dimensional representations of Lie groups and Lie algebras of classical series is considered in detail. Spinor representations of orthogonal Lie algebras and spinor Lie groups are discussed. (URSS Publishers: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru; URL: http://urss.ru/)

Fortov V E *Thermodynamics of the dynamic effect on matter* (Moscow: Fizmatlit, 2019) 144 pp. ISBN 978-5-9221-1840-8. RFBR project 19-12-00003.

The types of phase transitions accessible for realization in intense waves of isentropic compression and expansion and in high-power shock waves are considered on the basis of general thermodynamic relations. The consideration implies only the presence of local thermodynamic equilibrium in the system. The proposed formalism was used to study melting, high-temperature boiling, and plasmic phase transitions by dynamic methods. Depending on the thermodynamic properties of matter, thermodynamic conditions are formulated for the occurrence of instabilities of shock-induced discontinuity in a medium with an arbitrary equation of state. The book is intended for a wide range of specialists engaged in applied physics and new technology and for all physicists and mechanical engineers interested in modern high energy density physics. (Fizmatlit publishers: tel. +7 (495) 005-32-79; URL: http://www.fml.ru/, https://www.fmllib.ru/)

Zelenyi L M *Modern achievements in plasma heliogeophysics* (Ed. L M Zelenyi) (Moscow: Fizmatlit, 2018) 672 pp. ISBN 978-5-9221-1796-8.

Plasma heliogeophysics — a coeval of space research — can now be called an independent scientific discipline. Being at the interfaces of astrophysics, solar physics and solar system physics, earth sciences, and planet science, it studies objects and processes occurring between the Sun's and Earth's surfaces and considers them in the framework of electrodynamics and plasma physics. This book supplements and extends the unique two-volume edition *Plasma heliogeophysics* issued in 2008. The contemporary Russian-language literature has never had such complete modern monographs devoted to Sun–Earth relations, the Sun, and the heliosphere. The edition contains more detailed descriptions of some problems of plasma heliogeophysics that are closest to Russian authors. Some of them were not included in the two volumes, perhaps for lack of space or because significant new results have been obtained in recent years. The book was written by leading Russian specialists in theoretical and experimental research. It will be useful for specialists, postgraduates, and senior students. (Fizmatlit publishers: tel. +7 (495) 005-32-79; URL: http://www.fml.ru/, https://www.fmllib.ru/)

Marov M Ya, Voropaev S A, Ipatov S I, Badyukov D D, Slyuta E N, Stennikov A V, Fedulov V S, Dushenko N V, Sorokin E M, Kronrod E V *Moon formation and the early evolution of the Earth* (Moscow: URSS, 2019) 320 pp. ISBN 978-5-9710-7283-6.

The monograph contains the results of studies carried out by a team of researchers from the V I Vernadskii Institute of Geochemistry and Analytical Chemistry of RAS and supported by the Russian Science Foundation (project 17-17-01279). The studies were performed of a series of problems based on geological and geochemical investigations of ancient Moon crust and Moon volcanism using comparative analysis of measurement results from space equipment, laboratory examination of samples of a meteorite substance, and lunar rock from the unique GEOCHI RAS collection. A series of physico-chemical experiments was conducted with samples of an extraterrestrial substance, and the original data of mathematical simulation of processes associated with the formation of the Earth–Moon system are discussed. The goal is to obtain results providing insight into the Moon's early history. Examining the specificities of the shape and gravitational field of the Moon allows finding important analogs in evolution of both celestial bodies. It should be emphasized that the analysis of the Earth–Moon system is expected to give answers to a number of important questions concerning the origin and the evolution of the whole solar system. The combination of studies of celestial mechanical problems of the Earth–Moon system formation with geological and geochemical natural properties of the Moon is an important distinctive feature of the given RSF project. Another problem was the study of lunar resources, their mineral composition, the regions of their deposition, and global mapping. The book stresses the importance and topicality of the study of the early Moon and Earth, the interrelation of the problem of the formation of the Moon with the early geological history of Earth, and the advantages and limitations of the original conception. The book contains numerous color illustrations and will be of use to a wide range of young researchers as an integrated view of our planet and its satellite involving a number of natural disciplines (URSS Publishers: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru; URL: http://urss.ru/)

Sadovskii M V *Diagrammatics. Lectures on selected problems of condensed matter theory* 3rd edition revised and augmented (University textbooks and tutorials series) (Moscow–Izhevsk: Institute of Computer Science. Regular and Chaotic Dynamics, 2019) 392 pp. ISBN 978-5-4344-0837-0.

These lectures are aimed at demonstrating how the Feynman diagram technique is applied to the solution to concrete problems of the modern condensed state theory. The choice of these problems, which mainly refer to the theory of the electron properties of metals, is mainly due to their importance — some of them have not yet been solved completely. Therefore, further development of the approaches presented here may become the subject of an individual study. In most cases, all the details of calculations and different methodical techniques are presented, which makes the book useful for both experienced specialists and young theoreticians. (Institute of Computer Science publishing house of technical literature URL: http://shop.rcd.ru, e-mail: subscribe@rcd.ru, tel. +7 (3412) 500-295)

Shavrov V G, Buchel'nikov V D, Bychkov I V *Coupled waves in magnetics* (Moscow: Fizmatlit, 2019) 480 p. ISBN 978-5-9221-1859-0.

The monograph is devoted to the study of the interaction of spin, elastic, and electromagnetic waves in magnetic materials with different magnetic orderings. The magnetoacoustics of ferro-, antiferro-, and helical magnets are considered. The dispersion relations of coupled waves are analyzed with allowance for the interaction of spin and elastic subsystems and the electromagnetic field in the region of orientational phase transitions. A new type of surface magnetoelastic waves, nonlinear magnetoelastic waves, and the thermodynamics and kinetics of magnets in magnetic phase transitions are studied. The electromagnetic–acoustic conversion in ferro-, antiferro-, and spiral magnets is considered. The book is intended for specialists in the fields of magnetic phenomena and solid-state spectroscopy and for postgraduates and senior students of physical faculties. (Fizmatlit publishers: tel. +7 (495) 005-32-79; URL: http://www.fml.ru/, https://www.fmllib.ru/)

Ishkhanov B S, Kapitonov I M, Yudin N P *Particles and atomic nuclei* (Classical university textbook series) 4th edition, revised and supplemented (Moscow: URSS, 2019) 672 p. ISBN 978-5-9710-5616-4.

This book summarizes the long experience of teaching general courses on the physics of the atomic nucleus and elementary particle physics at the Faculty of Physics of Moscow State University. At the same time, the fundamentals and formalism of quantum physics are given. The material is presented in a way different from what is traditional. To begin with, the most fundamental components of matter, quarks and leptons, are presented, followed successively by increasingly larger objects — hadrons and atomic nuclei. This chain ends with a consideration of the cosmological aspects of particle and nuclear physics. The fundamental role of microworld laws in the formation of the structure of the Universe is shown. The book describes the most important experiments and gives a large number of examples. It contains the most relevant facts and can be used as a reference book. The fourth edition was thoroughly updated with new discoveries of the last five years taken into account. All numerical characteristics of particles and nuclei and parameters of their interaction are refined. The cosmological data are renewed; they now correspond to state-of-the-art information. The sections devoted to superheavy nuclei, quark mixing in weak interactions, quark-gluon plasma, and dark matter are rewritten. The sections devoted to fundamental symmetries and neutrino oscillations are considerably extended. The material concerning the nature of fundamental particle mass is presented anew with allowance for the historical discovery of the Higgs boson. The book will be of interest to second- and third-year students of physical faculties of universities. It will also be useful to senior students and specialists. Many of its sections are also accessible to a wider range of readers. (URSS Publishers: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru; URL: http://urss.ru/)

Arslanov V V *Nanotechnology. Colloidal and supramolecular chemistry. Encyclopedic reference book. More than 1000 vocabulary entries ordered according to English equivalents*

Stereotyped Edition (Moscow: URSS, 2019) 400 pp. ISBN 978-5-9710-6174-8.

This edition is an encyclopedic reference book on nanotechnology and colloidal and supramolecular chemistry containing more than 1000 vocabulary entries ordered according to English equivalents. The necessity to create such an inter-disciplinary reference book (glossary) is due to the fact that these related scientific disciplines use close or identical subjects and analogous approaches and methods and solve similar problems. This first dictionary on these topics includes new terms that appeared due to the occurrence and development of nanotechnology and supramolecular chemistry, which is also a very young scientific discipline. It is natural that these disciplines include colloidal chemistry as a precursor of nanotechnology and in many respects of supramolecular chemistry. Supramolecular and colloidal chemistry establishes a relation between nanotechnology and biology and medicine. Many living systems, such as cell ribosomes, viruses, and vesicles, are nanostructures, and their functions are realized at the nanolevel. It is therefore obvious that the elaboration of new systems important for biology — from bionanorobots and nanosensors to nanodrugs and nanovaccines — should include engineering using the methods of supramolecular and colloidal chemistry. In this connection, the closest and most important aspects of this area are taken into account in this reference book. Much room is occupied by terms concerning methods of obtaining low-dimensional systems, methods of studying their structure and properties, the applicability regions, and terms whose meaning has changed or widened. The dictionary presents acronyms, synonyms, and well-known names. For many phenomena and effects, historic information, measurement units, and applicability regions are given. Data on recently synthesized new compounds and materials are presented. The reference book contains over 1000 terms and nearly 200 illustrations. The dictionary includes a subject (alphabetic) index of Russian terms. Resources used by the author are given at the end of the book. Many definitions were either made more exact or formulated for the first time. The reference book is addressed to a wide range of readers interested in issues concerning nanoscience, nanotechnology, and colloidal and supramolecular chemistry. It will be useful to students, postgraduates, research workers, and engineers specializing in physics, chemistry, and biology of nanodimensional objects. (URSS Publishers: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru; URL: http://urss.ru/)

Romanovskii M Yu, Romanovskii Yu M *Mathematical principles of econophysics* (Moscow–Izhevsk: Institute of Computer Science, 2020) 360 pp. ISBN 978-5-4344-0849-3. RFBR project 20-11-00001.

The book presents a natural science approach to the solution to some problems of social sciences and economics. In the first part, special attention is paid to describing the stochastic dynamics of the stock market and individual incomes and expenses. Classical stochastic models of mathematical economics are briefly presented. Some scientometric problems are considered. The second part is devoted to dynamic models of economic phenomena. Among them are the demographic dynamics and measurements of human capital and different models of competition. The most interesting dynamic models of the economics of today's Russia and, in particular, the model of the Russian banking system are analyzed. The book covers a rather large area of economic and social problems and can be of great interest to a wide range of researchers and workers in the financial economic sphere, as well as senior students and postgraduates studying mathematical economics and scientometrics. (Institute of Computer Science publishing house of technical literature URL: http://shop.rcd.ru, e-mail: subscribe@rcd.ru, tel. +7 (3412) 500-295)

Kessenikh A V, Ptushenko V V *Magnetic resonance in the interior of the century*: *biographies and publications* (Moscow: Fizmatlit, 2019) 232 pp. ISBN 978-5-9221-1855-2.

This book is devoted to the 75th anniversary of the discovery of magnetic resonance and is a historico-bibliographic essay of the development of research in this area of science. The role of the prominent physicists E K Zavoiskii, E M Purcell, and F Bloch in the discovery and study of magnetic resonance phenomena is considered. Their biographies are described, and an analysis of the results of their research by the scientific community is presented. The development of magnetic resonance studies and the extension of their applicability region in the USSR after the discovery are shown. Extensive bibliographic material containing over 1000 references to selected original and review papers is given, as are historical publications devoted to the theory, discoveries, research, and most important applications of magnetic resonance effects. The book is intended for specialists in the field of magnetic resonance and its application in physics, chemistry, and biology and also for a wide range of readers interested in the history of science. The book cover is decorated with photographs from the Nobel Fund archive and private archives of N E Zavoiskaya, I I Silkin, and the authors. (Fizmatlit publishers: tel. +7 (495) 005-32-79; URL: http://www.fml.ru/, https://www.fmllib.ru/)

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