

## New books on physics and related sciences

DOI: 10.3367/UFNe.0183.201303k.0333

**Weinberg S** *Cosmology* (Translated from English by K B Alkalaev, V E Podobed, A V Berkov; ed. by I Arefeva, V Sanyuk) (Moscow: URSS, 2013) 608 pp. ISBN 978-5-397-03648-1.

The monumental monograph of Nobel Laureate in Physics 1979 Stephen Weinberg is a generalization of the progress achieved in the course of the last two decades in modern cosmology. It is unique in its coverage of the material, the manner of its presentation, and the thoroughness of the mathematical treatment. The objective of this monograph is to compile a closed description of cosmology, and of ideas and formulas which are used and tested in modern cosmological observations. Such an all-encompassing body of material has been brought together on the modern state of the theory for the first time. *Cosmology* can be organically split in two parts. The first four chapters are mostly devoted to treating the isotropic-on-average and uniform Universe. They analyze such fundamental blocks as the evolution of the Universe until the moment galaxies were formed, relic radiation, the early Universe, and the inflation period. The second part of the book (Chapters 5–10) focuses on analyzing various deviations in the Universe from the averaged state. Here, the general formalism and its application to the evolution of inhomogeneities are presented, and analysis is performed of the anisotropy of the cosmic microwave background, the large-scale structure, gravitational lensing, etc. The book does not just list the results obtained by numerical calculations but rather emphasizes the analytical description of cosmological phenomena that allow one to cut through to the gist of the matter. The *Cosmology* describes in detail many of the boldest modern ideas which are rarely encountered in review papers on cosmology; to get to that level, one has to delve into special papers. The monograph also presents actual measurements of cosmological parameters so as to open in front of the reader an array of success stories of observational science. Technical material required for understanding the main body of the text, a glossary of notations, and a set of interesting problems are collected into Appendices. The monograph includes a brilliant, exhaustive list of original publications. A distinguishing property of the book is its style and attention to the reader's needs, which result in impeccable formulations and the clearest presentation. There can be no doubt it will be of interest to every researcher doing cosmology as either experimentalist or theorist, as well as to physicists specializing in elementary particle physics. The text of the book used for translation was: Weinberg S, *Cosmology* (Oxford: Oxford Univ. Press, 2008). (Izdatelskaya gruppa URSS: Nakhimovskii prosp. 56, 117335 Moscow, Russian Federation; tel./fax + 7 (499) 724-25-45; e-mail: orders@URSS.ru; URL: <http://urss.ru/>)

**Fortov V E, Morfill G E (Eds)** *Complex and Dusty Plasmas: From Laboratory to Space* (Translated from English by A M Apfelbaum, S V Vladimirov, B A Klumov, V I Molotkov, S A Khrapak; ed. by A G Khrapak) (Moscow: Fizmatlit, 2012) 444 pp. ISBN 978-5-9221-1432-5.

The study of dusty or complex plasmas is a rapidly unfolding direction in modern physics; it includes various branches of physics of nonideal low-temperature plasmas. A dusty plasma constitutes an ionized gas that contains charged finely divided particles of condensed matter. Dusty plasmas are widely spread in nature and are utilized in a variety of technological processes. The present monograph treats a number of types of dusty plasmas and presents a detailed description of unique experimental and theoretical results that were obtained both in ground-based experiments and under microgravitational environments. Experts who are leaders in this field discuss the properties of gas-discharge, cryogenic, magnetized, and nuclearly excited dusty plasmas, as well as of plasmas excited by UV radiation. Special attention is paid to astrophysical aspects of dusty plasmas, the numerical simulation of their properties, interdisciplinary issues, and possible applications. The monograph can be of use to experts and postgraduate and undergraduate students engaged in the physics of low-temperature plasmas and gas discharge, in the study of the processes of crystallization and melting, in the development of materials and coats with prescribed properties, as well as in methods of diagnostics for highly dispersed media. The text of the book used for translation was: Fortov V E, Morfill G E (Eds) *Complex and Dusty Plasmas: From Laboratory to Space* (Boca Raton: CRC Press/Taylor & Francis, 2010). (Izdatelstvo Fizmatlit: ul. Profsoyuznaya 90, 117997 Moscow, Russian Federation; tel. + 7 (495) 334-74-21; fax + 7 (495) 334-76-20; e-mail: [fizmat@maik.ru](mailto:fizmat@maik.ru); URL: <http://www.fml.ru/>)

**Aktsipetrov O A, Baranova I M, Evtyukhov K N** *Nonlinear Optics of Silicon and Silicon Nanostructures* (Moscow: Fizmatlit, 2012) 544 pp. ISBN 978-5-9221-1402-8.

This book combines the characteristic traits of a monograph and a textbook. The silicon physical properties selected for description are those important from the standpoint of nonlinear optics. The basics of the phenomenological and microscopical approaches applied in the theory of generation of optical harmonics in silicon are presented. A complex model for the generation of the second harmonic at silicon interphase boundaries was proposed, so as to take into account the interference between various contributions to nonlinear-optical response, the anisotropy of the medium, the photogeneration of nonequilibrium carriers, and many other factors. A detailed analytical review of experimental work is presented, demonstrating the progress in nonlinear optics of silicon and silicon nanostructures, as well as its modern state of the art. The book is intended for researchers, engineers,

postgraduates and senior-year students who major in non-linear optics and in the spectroscopy of the Si surface, as well as in the micro- and nanotechnologies of silicon. (Izdatelstvo Fizmatlit: ul. Profsoyuznaya 90, 117997 Moscow, Russian Federation; tel. + 7 (495) 334-74-21; fax + 7 (495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

**Suzdalev I P** *Nanotechnology: Physical Chemistry of Nanoclusters, Nanostructures, and Nanomaterials* (Series 'Synergetics: from the Past to the Future', Issue 25) (Moscow: URSS, 2013) 592 pp. ISBN 978-5-397-03389-3.

The book brings together a range of topics which may integrate into a science of nanoobjects, i.e., the processes and phenomena unfolding on scales between 1 and 100 nm. In this region, we observe effects sensitive to both individual atomic-molecular energy levels and to collective properties of bodies. Progress in the science of nanoclusters and nanosystems and in the methods of studying them led to the creation of nanotechnology, nanomaterials, and nano-devices, all distinguished by their unique properties and promises of application. The book makes an attempt at merging theoretical and experimental data on nanoclusters and nanosystems with certain issues of a more general, introductory nature: techniques for studying nanoclusters and surfaces of solids, and microscopic and thermodynamic approaches to studying nanoclusters and surfaces. This structure of the book is reflected here owing to the author's work at the Semenov Institute of Chemical Physics of the RAS and delivering a course of lectures on the physical chemistry of nanoclusters and nanostructures at Lomonosov Moscow State University in the Department of Materials Sciences. The book is intended for undergraduate students and postgraduates, as well as for researchers pursuing investigations into nanotechnologies or beginning to work in the field. (Izdatelskaya gruppa URSS: Nakhimovskii prosp. 56, 117335 Moscow, Russian Federation; tel./fax + 7 (499) 724-25-45; e-mail: orders@URSS.ru; URL: <http://urss.ru/>)

**Shulga N F** *Some Aspects of the Theory of Fast Particle Scattering in Matter* (Kyiv: Naukova Dumka, 2010) 198 pp. ISBN 978-966-00-0859-7.

The monograph presents the classical theory of the elastic scattering of fast charged particles in fields of complicated configurations, such as atomic systems, amorphous and crystalline media, and bunches of relativistic particles. The results obtained during the last several years are outlined. Theories of such phenomena as rainbow scattering, glory and twisting in the scattering of fast particle by atomic systems, multiple scattering of particles in various media, and orientational effects in particle scattering in rectilinear and bent crystalline structures. The material included in this volume is based on part of the course of lectures that the author delivers at the Physicotechnical Department of V N Karazin Kharkov National University. The book is intended for specialists engaged in theoretical and experimental research into physics branches connected with problems of interaction between particles and matter and particles and external fields, as well as for postgraduates and undergraduate students of technical colleges. (DP NVP Vidavnistvo Naukova Dumka NAN Ukraini: vul. Tereshchenkivska 3, 01601 Kyiv 1, Ukraine; tel/fax + 380 (44) 235-41-70; e-mail: nfo@ndumka.kiev.ua; URL: <http://www.ndumka.kiev.ua/>)

**Filachev A M, Taubkin I I, Trishenkov M A** *Solid State Photoelectronics: Photoresistors and Photodetectors* (Moscow: Fizmatkniga, 2012) 368 pp. ISBN 978-5-89155-210-4.

Physical phenomena in semiconducting photoresistors and the principles of designing microelectronic photosensor devices are described in detail and with minimal referencing to other sources. Descriptions are provided to single-crystal and polycrystalline photoresistors based on silicon and germanium, lead and cadmium chalcogenides, indium antimonides, and cadmium-mercury-tellurium, as well as quantum-dimensional structures. The structures, circuitry, and design features of integrated and hybrid photodetectors are discussed, including matrix shapers of image signals. A description is given of the basic characteristics of industrial photoresistors and photosensor devices that are sensitive to various spectral ranges of optical radiation, from UV to IR. Special attention is paid to the detection of very low optical signals, to their filtration from noise using photosensor devices. This monograph is the third (and last) in the series of lecture courses devoted to 'Solid State Photoelectronics'. These monographs define the state of the art in solid state photoelectronics up to the end of the first decade of the 21 century. The first monograph [Filachev A M, Taubkin I I, Trishenkov M A *Solid State Photoelectronics: Physics Foundations* (Moscow: Fizmatkniga, 2007)] describes the main types of photodetectors and provides information on quantum physics and optics, solid state physics, and statistical radioengineering required for understanding the operation principles of photoelectron devices. The second monograph [Filachev A M, Taubkin I I, Trishenkov M A *Solid State Photoelectronics: Photodiodes* (Moscow: Fizmatkniga, 2011)] presents analysis of physical phenomena in the most widespread solid state photoelectron devices — semiconductor photodiodes, including photodiodes based on heterotransitions and quantum-dimensional structures. The structures and characteristics of industrial and recently developed small-area and matrix photodiodes manufactured from Si, Ge, semiconducting InGaAs, InSb, CdHgTe, SiC, and AlGaIn compounds, as well as from superlattices and other materials, are described. These monographs addressed researchers, postgraduates, practising engineers, teachers, and undergraduate students and were rated as textbooks. (Izdatelstvo Fizmatkniga: Institutskii per. 66, 141700 g. Dolgoprudnyi, Moscow region, Russian Federation; tel/fax. + 7 (495) 971-26-04; e-mail: zakaz@fizmatkniga.ru; URL: <http://www.fizmatkniga.ru/>)

**Karmazinov F V, Kostyuchenko S V, Kudryavtsev N N** (Eds) *UV-Radiation in Industrial Ecology: Treatment of Water, Air, and Surfaces*. Textbook and Reference Guide (Moscow: Intellect-Center, 2012) 624 pp. ISBN 978-5-91559-121-8.

The book is intended to treat various types of UV radiation action (bactericide, photochemical, biological) and the technologies based on them. Special attention is paid to UV technology for decontaminating natural, industrial, and waste waters, air, and surfaces, which has developed intensely by virtue of its ecological safety and high efficiency in the last 20 years. Prospects are considered for the application of UV technologies for the purposes of water and air purification from impurities they contain and removal of smells — such as activated photooxidation and photocatalysis. A review is given of the physical and technological

foundations of the modern sources of UV radiation, the basic principles are presented for the design and construction of UV equipment, and examples are given of the implementation and exploitation of various UV systems. The book is intended for experts who utilize UV technologies for the disinfection and purification of water and air, in photochemistry and photobiology, and also for developing UV equipment and sources of UV radiation. It may be of use to undergraduate students and postgraduates specializing in engineering and technical fields, or mastering the professions of physicians and ecologists. (Izdatel'stvo Intellect-Center: ul. Butlerova 17-B, 117342 Moscow, Russian Federation; tel. +7 (495) 330-08-83; e-mail: [incent@com2com.ru](mailto:incent@com2com.ru); URL: <http://www.intellectcentre.ru/>)

**Nicholls J G, Martin A R, Wallace B G, Fuchs P A** *From Neuron to Brain* (Translated from English by P M Balaban, A M Galkin, R A Giniatullin, R N Khazipov, L S Khirug; edited by P M Balaban, R A Giniatullin) 3rd stereotype ed. (Moscow: URSS, 2012) 672 pp. ISBN 978-5-397-02216-3.

Here, the reader is offered the famous book *From Neuron to Brain*, which became a classic for neurobiology. Its authors are widely known neurobiologists who succeeded in presenting in a clear and consistent form the established facts, the methodological approaches, and the concepts, invariably emphasizing both the classical and the most modern experimental data. Nicholls et al. explain brain behavior and complex functions in terms of activities of nerve cells (neurons); they discuss the cellular and molecular mechanisms of interneuron interaction and study the mechanisms of the formation of structures and connections which lie at the foundation of the functions of the developing organism. The book displays a large number of illustrations; not only is each problem outlined as such, but so are its genesis and its relation to other aspects of neurobiology. The distinguishing feature of this book is that its authors do not avoid debatable subjects but prefer to give available alternative points of view, and do not shy away from demonstrating that many serious problems remain unsolved. The first edition in English appeared in 1975, was translated into Russian, and became a must-have desktop volume on all aspects of brain physiology for several generations of researchers. More than three fourths of the 4th edition in English, the source of this translation, was undated and this is thus a completely new book: the last three decades have brought about quite wonderful discoveries in the field that we call the science of brain. In fact, though, the objective of the monograph has remained the same as it was formulated by the authors in the introduction to the first edition: "...to describe the methods by which signals are transmitted by nerve cells, how they are analyzed, and how the higher functions of the brain arise on the basis of this integration." As stated by the authors, the book is intended for readers having no special education but who wish to learn the principles guiding the functioning of the nervous system. This title has been included as recommended additional reading in practically every Russian course on brain functioning for students at medical and biological universities. It will help students to gain and master knowledge of the nervous system; it will also be of use to students of other natural sciences, such as physicists, engineers, and molecular biologists. Translated from the following edition: Nicholls J G, Martin A R, Wallace B G, Fuchs P A *From Neuron to Brain: A Cellular and Molecular Approach to the*

*Function of the Nervous System* 4th ed. (Sunderland, Mass.: Sinauer Associates, 2001) (Izdatel'skaya gruppа URSS: Nakhimovskii prosp. 56, 117335 Moscow, Russian Federation; tel./fax + 7 (499) 724-25-45; e-mail: [orders@URSS.ru](mailto:orders@URSS.ru); URL: <http://urss.ru/>)

**Romanovskii M Yu, Romanovskii Yu M** *Introduction to Econophysics: Statistical and Dynamic Models* 2nd ed., revised and expanded (Moscow–Izhevsk: Institute for Computer Research, 2012) 340 pp. ISBN 978-5-4344-0087-9.

This book offers a natural-sciences approach to solving certain problems in economics. Part I pays special attention to describing the stochastic dynamics of the stock exchange and individual incomes and expenditures. Classical stochastic models of mathematical economics are also briefly outlined. Part II is devoted to dynamic models of economic phenomena. The reader will find among them demographic dynamics and various models of competition. The most interesting dynamic models in modern Russian economics, such as the model of Russia's banking system, are described. The book covers a sufficiently large range of economics problems and will be of great interest to a large number of researchers and operatives in the sphere of economic and financial activities, as well as to senior-year students and postgraduates learning mathematical economics. (Research and Publication Center Regular and Chaotic Dynamics: ul. Universitetskaya 1, 426034 Izhevsk, Russian Federation; tel. +7 (3412) 50-02-95; e-mail: [subscribe@rcd.ru](mailto:subscribe@rcd.ru); URL: <http://shop.rcd.ru/>)

**Kulikovskii P G** *Handbook for the Astronomy Amateur* (Ed. by V G Surdin) (Moscow: Librokom, 2013) 704 pp. ISBN 978-5-397-03367-1.

This handbook presents the problems and techniques used in modern astronomy and gives a description of celestial bodies—stars, planets, comets, etc. The methods of astronomical observations affordable on an amateur's modest budget are described. The rich reference material has been fully updated and reflects the achievements of recent years. When preparing the 6th edition, some text and tables were expanded and misprints found in the 5th edition were revised. The handbook was intended for amateur astronomers, high-school astronomy teachers, lectures, and members of astronomy hobby groups. It will also be of use for expert astronomers and for professional observers at artificial satellite monitoring stations, as well as for researchers in related fields of science. (Izdatel'skaya gruppа URSS: Nakhimovskii prosp. 56, 117335 Moscow, Russian Federation; tel./fax + 7 (499) 724-25-45; e-mail: [orders@URSS.ru](mailto:orders@URSS.ru); URL: <http://urss.ru/>)

**Dmitrii Vladimirovich Skobeltsyn** (Photo album) (Compiled by T M Roganova, V M Berezanskaya, M A Lukichev) (Rybinsk: RMP, 2011) 208 pp.

This photo album is devoted to the 120th anniversary of the birth of Academician D V Skobeltsyn, an outstanding physicist of the 20th century and a father figure in Russian nuclear physics, who created a large-scale scientific school in nuclear physics, elementary particles physics, and cosmic rays physics; he also came to be one of the most important science organizers. Most of the material in the album is published for the first time. The publication was supported by the

P N Lebedev Physical Institute of the RAS and the D V Skobel'syn Nuclear Physics Institute of MGU. (Izdatel'stvo RMP: ul. Krestovaya 55, 152901 Rybinsk, Russian Federation; tel. + 7 (4855) 28-37-80; fax + 7 (4855) 28-01-10; e-mail: rmposad@mail.ru; URL: <http://izdatelstvo-rmp.ru/>)

**Trubetskov D I** *The Science of Complexities in Faces, Fates, and Dates: How the Foundations of Synergetics Were Built: The Feast of the Spirit and the Drama of Ideas* (Series 'Synergetics: from the Past to the Future', Issue 62) (Moscow: Librokom, 2013) 312 pp. ISBN 978-5-397-02793-9.

The wondrous discoveries in nonlinear science made during recent decades have turned science into a huge attractor. To a certain extent, this interest is now covered by numerous publications of monographs, textbooks, and popular science volumes — indeed, there are more than 60 books alone in the series 'Synergetics: from the Past to the Future' published by the URSS publishing company. Only one aspect still remains in the dark: how was nonlinear science born, how did its ideas evolve, why were the fates of its creators as tragic as they often were. In fact, it is the process of maturation of nonlinear science that we find exciting and intriguing, together with the dynamics of its evolution, the replacement of one set of concepts by a competing one, plus the life of its creators — in other words, the history of nonlinear science. This book makes an attempt to compose a calendar of important events in the evolution of nonlinear science against the background of biographies of its creators, starting at the time when the term 'nonlinear science' had not yet been invented. The mathematical apparatus of the book is the simplest possible: its main tool is the analysis of dimensions. The book is intended for undergraduate students and postgraduates studying the history of natural sciences. It can also be useful to teachers, school students in the senior years, university lecturers, and anyone interested in the history of sciences. (Izdatel'skaya gruppa URSS: Nakhimovskii prosp. 56, 117335 Moscow, Russian Federation; tel./fax + 7 (499) 724-25-45; e-mail: [orders@URSS.ru](mailto:orders@URSS.ru); URL: <http://urss.ru/>)

**Astapenko V A** *Electromagnetic Processes in Media, Nanoplasmonics, and Metamaterials* (Dolgoprudnyi: Intellect, 2012) 584 pp. ISBN 978-5-91559-111-9.

The book concentrates on a presentation of the theory of electromagnetic processes in a medium, including radiative, collisional and collisional–radiative phenomena in plasmas, in condensed matter, at interfaces separating two media, and in metamaterials. Models of dielectric and magnetic susceptibilities of matter are treated both generally and in the case of media with negative refraction. A transition from microscopic to macroscopic Maxwell equations making use a detailed description of dynamic polarizability of atoms in the medium is achieved in a consistent way. The book discusses both familiar phenomena and a number of important electromagnetic processes not rooted in the conventional electrodynamics of continuous media but gaining importance in the context of the modern evolution of physics. They comprise: polarization-induced bremsstrahlung in a plasma, condensed matter and nanostructures, and scattering of ultrashort pulses in plasmas by atoms and nanoparticles. The main characteristics and methods of excitation of surface plasmons are considered both on planar

surfaces and in nanoparticles. Considerable attention is paid to media with negative refraction and to methods of creation of metamaterials of this kind. As examples of the practical implementation of nanoplasmonics, work is demonstrated on nanoantennas, surface-enhanced Raman spectroscopy, spasers, photodetectors, and solar batteries. In addition to traditional approaches, poorly known models and approximations are considered that have proved successful for practical use, such as the rotational approximation in the Kramers electrodynamics, the method of local plasma frequency for describing radiative processes, and the Born–Compton approximation in the theory of collisional ionization of atoms. The book utilizes modern experimental data. It is addressed to senior-year students, postgraduates, teachers of physics and engineering physics departments, researchers, and developers. (Izdatel'skii dom Intellect: Promyshlennyyi proezd 14, 141700 Moscow region, Dolgoprudnyi, Russian Federation; tel. + 7 (495) 579-96-45; fax + 7 (495) 617-41-88; e-mail: [solo@id-intellect.ru](mailto:solo@id-intellect.ru); URL: <http://www.id-intellect.ru/>)

**Gorshkov O A, Muravlev V A, Shagaida A A** *Hall and Ionic Plasma Engines for Space Vehicles* (Ed. by Academician A S Koroteev) (Moscow: Mashinostroenie, 2008) 280 pp. ISBN 978-5-217-03440-6.

This book highlights the latest results of modern research into what are currently the most demanded types of electric rocket engines — Hall and ionic plasma engines designed for applications as elements of variously profiled space vehicles. Approaches are described to modeling the main physical processes in engines, schemes, and design units, and engine characteristics are analyzed (for the development stage from lab models to flight units). The book is intended for experts in space rocket technologies, postgraduates, and undergraduate students. (Izdatel'stvo Mashinostroenie: Stromynskii per. 4, 107076 Moscow, Russian Federation; tel. + 7 (499) 269-52-98; e-mail: [realiz@mashin.ru](mailto:realiz@mashin.ru); URL: <http://www.mashin.ru/>)

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