

## New books on physics and related sciences

DOI: 10.3367/UFNe.0183.201305k.0559

**Feynman R Ph** *QED: The Strange Theory of Light and Matter* (Translated from English by S G Tikhodeev, O L Tikhodeeva) (Moscow: Astrel, 2012) 192 pp. ISBN 978-5-271-40796-3.

This volume is based on the famous series of lectures that Richard Feynman presented to the audience at the University of California. They are unique in being intended for teachers and students of the faculties of humanities, i.e., people who are totally unprepared to understanding such seemingly complicated material as quantum electrodynamics. Nevertheless, the renowned physicist succeeded in presenting the theory — he himself took part in creating it — using simple and clear language. It was no accident that critics characterized the book — even about the very first Princeton edition of this series — as “bringing to the reader Feynman’s engaging and witty style which made quantum electrodynamics not only comprehensible but also pure fun!” [Translated from the edition: Feynman R Ph *QED: The Strange Theory of Light and Matter* (Princeton: Princeton Univ. Press, 2006). (Publishing Group ACT: tel. +7 (495) 615-01-01, fax +7 (495) 615-51-10; e-mail: astpub@aha.ru; URL: <http://www.ast.ru/>)]

**Ishkhanov B S, Kapitonov I M, Yudin N P** *Particles and Atomic Nuclei* 3rd ed., revised and expanded. (Ser. Classical University Textbook) (Moscow: URSS, 2013) 584 pp. ISBN 978-5-397-03880-5.

This book is the concluding part of the course of general physics devoted to elementary particles and atomic nuclei. It is based on a lecture course given to students of the Faculty of Physics of Moscow State University (MSU). The content of the book complies with the program of the State Education Standard. The selection of the material, the organization, and the form of presentation are original and match both the style of university-level education in physics and the traditions of the MSU Faculty of Physics. The exposition of the material begins with the most fundamental constituents of matter, leptons and quarks, and climbs successively to larger and larger objects: hadrons and atomic nuclei. This chain ends with an examination of the cosmological aspects of the physics of elementary particles and nuclei. The presentation is based on updated factual material. Basic physics experiments are described. The theoretical description of the material is accompanied with solutions to problems and examples, which helps to achieve a deeper grasp of the material under study. As the book pays maximum attention to laying bare the physics of phenomena, not all topics go to the same depth of detail. It must be borne in mind, however,

that the study of general physics is accompanied — in accordance with the university program — by seminars and practicum sessions. It was taken into account when writing the book that students are not yet familiar with the basics of quantum mechanics. For this reason, one of the chapters outlines the basic concepts and relationships of quantum physics. When presenting the material, the authors have tried to explain the physical nature of the phenomena and avoid, as much as possible, mathematical derivations of equations; they also omitted certain details essential for a more in-depth study of the subject. Research in nuclear and particle physics gave rise to drastically new profound concepts for describing phenomena occurring in the microcosm. The main content of the book aims at helping to clarify the sense and message of these phenomena. It considers, along with the phenomena in the microscopic world, certain aspects of the evolution of the Universe. Despite the huge difference between the scales of the physics of the microcosm and of cosmology, the latter cannot be understood without understanding the former. Consequently, incorporation of this material into the book is a necessary step. An in-depth course of modern astrophysics is given to students of the MSU Faculty of Physics immediately after the course ‘Nuclear and particle physics’, which provides good opportunities for students to better learn the general topics taught in these two courses. Some reference subjects are placed in Appendices, such as the tables of isotopes, fundamental physical constants and units of measurements, the most important discoveries of microphysics that brought about our current understanding of physics, and a list of Nobel Prize winners in Physics. The book contains the most modern factual material and can be used as a handbook. It is intended for undergraduate physics students, postgraduates, as well as for researchers. (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/>)

**Smirnov B M** *Processes Involving Small Particles in Excited or Ionized Gas* (Monograph) (Moscow: Logos, 2012) 192 pp. ISBN 978-5-98704-656-2. RFBR project 12-02-07010.

The text describes different types of nanoparticles and microparticles in gases and considers various processes occurring in gaseous media involving small particles, from the standpoint of interaction between these particles and atomic particles in the buffer gas. The author considers two contrasting modes of interaction, the kinetic and the diffusion-driven modes, for a broad range of processes with the participation of small particles (clusters). In the first case, the behavior of a cluster in a buffer gas resembles the behavior of an atomic particle, and its collision with an atomic particle of the gas or with another cluster occurs independently of other collisions as if the particle were in free space. In the diffusive mode, the motion of the cluster or of

atomic particles taking part in the process is determined by their diffusion or mobility in the ionized gas. The criteria for the kinetic and diffusive modes are given for the transport processes of clusters and small particles in a gas, processes of the charging of clusters and the combustion of gas particles, as well as of nucleation processes that include the growth of clusters as a result of adhesion of atoms to them, coagulation, and coalescence. The rates of the appropriate processes are analyzed in terms of the liquid droplet model for small particles, and of the hard-sphere model for processes involving them. (Izdatetskaya gruppa Logos: ul. Aviamotornaya 55, korp. 31, ofis 305, 111024 Moscow, Russian Federation; tel. + 7 (495) 504-37-62; e-mail: universities@mail.ru; URL: <http://logosbook.ru/>)

**Kuznetsov S P** *Dynamical Chaos and Hyperbolic Attractors: From Mathematics to Physics* (Moscow–Izhevsk: Institute for Computer Sciences, 2013) 488 pp. ISBN 978-5-4344-0100-5.

The book is devoted to considering the feasibility of implementation in physical systems of structurally stable chaos caused by the presence of uniformly hyperbolic attractors, such as Smale–Williams solenoids, Smale DA attractors, and Plykin type attractors. A review is given of the substantive part of the hyperbolic theory, and also of the possible situations in which hyperbolic attractors may appear. Examples of systems with such attractors are constructed on the basis of physical principles. Methods of computerized testing of hyperbolicity are discussed and illustrations of their application are given. Also discussed is the modeling of electronic devices with hyperbolic attractors and methods for observation of hyperbolic chaos in laboratory experiments. The book is intended for undergraduate students, postgraduates, and researchers in nonlinear dynamics and its applications. (Scientific 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/>)

**Kolmakov A, Barinov S, Alymov M** *The Basic Technologies and Applications of Nanomaterials* (Moscow: Fizmatlit, 2012) 208 pp. ISBN 978-5-9221-1408-0.

The monograph is concerned with generalization of the results of investigation in the field of production technology and the application of nanomaterials. It analyzes both the results obtained by the authors of the monograph in carrying out the projects supported by RFBR, and data published in the literature, including publications in this country. Possible future applications of nanomaterials are discussed, along with the causes making them so specific; the main approaches to establishing the terminology and classification are analyzed; the basic methods for manufacturing nanomaterials are given, linked to the properties and applications of the materials and final products obtained, and the main areas of application and possible limitations are generalized. The monograph is intended for researchers and practising engineers, as well as postgraduates and senior-year students. Numbers of illustrations: 148, tables: 5, and references: 397. Reviewed by Academician M V Alfimov, and Academician V M Ivlev. (Izdatel'stvo 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/>)

**Smirnov B M** *Properties of Gas-Discharge Plasmas* (SPb: Polytechnic University Publishing House, 2010) 363 pp. ISBN 978-5-7422-2564-5. RFBR project 09-02-07007-d.

Gas-discharge plasma, i.e., ionized gas supported by external electromagnetic fields, constitutes a nonequilibrium system because the energy from an external electrical source is first transferred to electrons and from them to atoms or molecules of the gas. Therefore, the properties of a gas-discharge plasma are determined by the processes occurring in it, which leads to a variety of modes of gas-discharge plasma, depending on the external conditions, geometry, and composition of the plasma. This book, devoted to the theory of gas-discharge plasma, consists of three parts: Part 1 deals with the general principles of gas-discharge plasma; Part 2 covers the kinetics of gas-discharge plasma, and Part 3 focuses on several individual problems for which the author chose various aspects of helium and argon gas-discharge plasmas. The book also contains reference material relevant to these subjects. The book is intended for undergraduate students and postgraduates, as well as for professional researchers encountering with gas discharge. (Izdatel'stvo Politekhnikheskogo Universiteta: Politekhnikheskaya ul. 29, 195251 St. Petersburg, Russian Federation; tel./fax + 7 (812) 702-77-18; e-mail: [kiseleva@gupress.ru](mailto:kiseleva@gupress.ru); URL: <http://gupress.ru/>)

**Rubin A B** *Biophysics* In 3 volumes (Moscow–Izhevsk: Institute for Computer Sciences, 2013).

Vol. 1 *Theoretical Biophysics* 472 pp. ISBN 978-5-4344-0101-2.

Vol. 2 *Biophysics of Cell Processes: Biophysics of Membrane Processes* 384 pp. ISBN 978-5-4344-0102-9.

Vol. 3 *Biophysics of Cell Processes: Mechanisms of the Primary Photobiological Processes* 480 pp. ISBN 978-5-4344-0103-6.

These volumes constitute a fundamental textbook in biophysics, which present the foundations of the modern biophysical sciences. Volume 1, *Theoretical Biophysics*, expounds the theoretical foundations of biophysics and includes the following sections: kinetics, thermodynamics, mathematical modeling of biological processes, basics of molecular biophysics, and the dynamics of biopolymers. Volume 2 of the textbook, *Biophysics of Cell Processes: Biophysics of Membrane Processes*, treats the physicochemical mechanisms of a number of major processes taking place in organisms. The structure and functioning of biological membranes, bioelectrogenesis, muscle contraction, reception, electron transport, and energy transformation in biological membranes are characterized in detail. Material is given on the molecular mechanisms of ion channel functioning. The third volume of the textbook, *Biophysics of Cell Processes: Mechanisms of the Primary Photobiological Processes*, comprises chapters relevant for the electronic properties of biopolymers, the concept of the physical mechanisms underlying the electron transfer in biological structures, in which the idea of an active role of proteins in the mechanisms and ways of electron transport are now firmly established. Mechanisms are discussed of the initial stages of photobiological processes, including photosynthesis, vision, and photochemical reactions in biopolymers. The books are intended for a broad range of readers of quite various profiles, including undergraduate students, postgraduates, and researchers interested in the

fundamental problems of modern physico-chemical biology. The reader is assumed to be familiar with the basics of biological disciplines, physics, chemistry, and calculus as these are taught to students of biological specialties in the framework of general courses given to them during the first three years of university in Russia. The necessary new information on physics and mathematics are provided where required throughout the volumes. Recommended by the Educational and Methodical Body on Classical University Education as a textbook for students of higher educational institutions majoring in 020400 (020200) 'Biology', and in 020207 'Biophysics' specialties. (Scientific 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/>)

**Vazhenin N A, Obukhov V A, Plokhikh A P, Popov G A**  
*Electric Rocket Engines of Space Vehicles and Their Impact on Radio Space Communications* (Moscow: Fizmatlit, 2012)  
432 pp. ISBN 978-5-9221-1410-3.

The monograph deals with the principles of designing modern radio space communications networks and with their integration with electric rocket engines (EREs) of spacecraft in the near and deep space. The technical characteristics of modern EREs are given and the main factors of how they affect spacecraft and on-board radio systems are discussed. Modern methods of researching the operation of EREs on the ground are considered and original experimental results, obtained by the authors in their analysis of electromagnetic radiation generated by electric rocket engines, are given. Using these and the already familiar experimental data, the authors submit new phenomenological models that describe ERE radiation in the spectral and temporal domains. They formulate and solve the problem of imitative modeling of the effects produced by EREs on the quality factors characterizing the functioning of radio systems for communication in outer space. The book will be of interest for design and research staff engaged in developing radio systems equipped with EREs for communications with space vehicles in near and deep space, and may also prove useful for senior students, postgraduates, and teachers in higher educational establishments, who are majoring in the corresponding fields. (Izdatel'stvo 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/>)

Compiled by *E V Zakharova*  
(e-mail: [zaharova@ufn.ru](mailto:zaharova@ufn.ru))