# New books on physics and related sciences

**Cherepashchuk A M** *Close Binary Stars* Part I (Moscow: Izd-vo Fizmatlit, 2012) 560 pp. ISBN 978-5-9221-1416-5.
**Cherepashchuk A M** *Close Binary Stars* Part II (Moscow: Izd-vo Fizmatlit, 2013) 576 pp. ISBN 978-5-9221-1467-7.

Owing to advances in X-ray astronomy, the problem of close binary stars has become one of the central issues in astrophysics. This monograph presents modern research methods and deep insights into the fundamental character-istics of stars, namely, their masses, radii, and temperatures. This makes close binaries a powerful tool for investigating the physics and evolution of stars and discovering and examining essentially new objects in the Universe: neutron stars and black holes. The monograph (Parts I and II) will provide an invaluable reference source for students and postgraduates, for professors and lecturers in universities, and for research workers interested in the problems of stellar physics and relativistic astrophysics. (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fiz-mat@maik.ru; URL:http://www.fml.ru/)

**Zeldovich Ya B** *The Theory of Shock Waves and an Introduction to Gas Dynamics* 2nd edition (Moscow: Izd-vo URSS, 2014) 192 pp. ISBN 978-5-9710-1093-7.

This book has been written by the outstanding Soviet physicist Ya B Zeldovich. It is devoted to the theory of shock waves and gas dynamics. The key subject of the book comprises shock waves, which are of particular interest from a number of viewpoints. The author examines specific phenomena concerned with gas dynamics, i.e., phenomena that have no analogues in incompressible fluid mechanics. The main emphasis accentuates not on computational methods of gas dynamics but on establishing its fundamental basic essentials, the limiting laws and methods of solving the simplest problems. The book also considers the reactive force theory, the phenomena of the origin and propagation of air explosive waves that determine the destructive effect of an explosion. The first edition appeared in 1946 in the Publishing House of the USSR Academy of Sciences. The book is recommended to physicists, mechanical engineers, mathe-maticians, practising engineers, students, and postgraduates of corresponding specialties. (URSS Publ.: 117335 Moscow, Nakhimovskii prospekt 56; tel./fax: +7 (499) 724-25-45; e-mail: urss@URSS.ru; URL: http://urss.ru/)

**Huntress W T (Jr.), Marov M Ya** *Soviet Robots in the Solar System: Mission Technologies and Discoveries* (Moscow: Izd-vo Fizmatlit, 2013) 608 pp ISBN 978-5-9221-1427-1.

The program of cosmic research in the USSR started and was implemented in the first decades of the space age in the atmosphere of the cold war and tough competition with the USA for the leading positions in the world. This period is marked by outstanding scientific and technical advances owing to the exceptional talent of Soviet scientists and engineers who created the remarkable robotized space vehicles, and produced pioneering epoch-making results. This book contains a chronologically complete and objective analysis of these achievements, including the difficulties and failures in implementing far-reaching technical programs against the background of Soviet–American rivalry in this area. It presents the most comprehensive technical descrip-tion of the Soviet lunar-planetary space establishment, gives a unique analysis of research programs, technical solutions and scenarios of flights, considers the planning of space missions, results obtained, and causes of failures, and reflects the depth and technical perfection of space projects, which enabled the USSR to assume the leadership in research of the Moon and Solar System planets using automated equipment in the second half of the 20th century. This book is intended for a wide circle of readers interested in space studies. English translation: Huntress W T (Jr.), Marov M Ya, Soviet Robots in the Solar System: Mission Technologies and Discoveries. (New York: Springer, 2011). (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fizmat@maik.ru; URL:http://www.fml.ru/)

**Savinov V P** *Physics of High-Frequency Capacitive Discharge* (Moscow: Izd-vo Fizmatlit, 2014) 308 pp. ISBN 978-5-9221-1551-3.

The physical mechanism underlying the high-frequency (rf) capacitive discharge (RFCD) at low and medium pressures and the discharge plasma properties are described in detail. The basic processes and characteristics of RFCD and the specificities of electrical breakdown in a high-frequency field are investigated. A new RFCD classification is proposed, the frequency of an RF field is interpreted as a fundamental discharge parameter. The properties of near-electrode regions of space discharge, the nature of the electric field in them, and the charge transport to the electrodes are thoroughly examined. The boundary effects in RFCD are analyzed with allowance for such previously unknown processes as the discrete mechanism of plasma electron transport to the electrodes and the edge effect. Particular attention is paid to the discovered occurrence of near-electrode electron beams. The properties of RFCD plasma are studied for different discharge regimes. Diagnostic methods of RFCD are also investigated in detail. This monograph is intended for research workers engaged in gas-discharge and low-tempera-ture plasma physics, students, and postgraduates in the corresponding specialties. (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fiz-mat@maik.ru; URL:http://www.fml.ru/)

**Kvasnikov I A** *Introduction to the Theory of Ideal and Non-Ideal Bose Gases* (MGU 'Classical Textbooks' Series) (Moscow: Izd-vo Librokom, 2014) 240 pp. ISBN 978-5-9710-1179-8.

The book submitted to the attention of the reader is devoted to one of the most complicated and not yet comprehensively elaborated fields of statistical theory of nonideal many-body Bose systems. Some disputable points of the existing theory of such a system, compared traditionally with the degenerate state of liquid helium below the point of its Bose condensation, are presented successively in an easily accessible form using two-time temperature formalism in quantum-statistical problems. The book reflects essentially the lecture course delivered by the author for fifth-year students at theoretical departments of Moscow State University Faculty of Physics — that is, for an audience quite well trained in theoretical and mathematical physics. During preparation of the book edition, the lectures were naturally supplemented with preliminary material of a general physical character, appendices helpful in the case of possible lack of information in some theoretical and technological questions, and some additional data. All this makes this textbook much more comprehensive and easily understood for a wider range of readers, even those not connected with the university level of preparatory. The book is intended for senior students and postgraduates mastering theoretical physics, and for research workers interested in the general issues and problems of quantum statistics. (URSS Publ.: 117335 Moscow, Nakhimovskii prospekt 56; tel./fax: +7 (499) 724-25-45; e-mail: urss@URSS.ru; URL: http://urss.ru/)

**Sumbatyan M A, Skaliya A** *Basic Principles of Diffraction Theory with Applications in Mechanics and Acoustics* (Moscow: Izd-vo Fizmatlit, 2014) 336 pp. ISBN 978-5-9221-1534-6.

This monograph is concerned with the basic principles of diffraction theory with applications to the problems of mechanics and acoustics. Necessary information from mathematical analysis and the theory of wave processes is presented. The problems of diffraction in an unbounded medium, by rectangular scatterers, and from a constant-thickness layer are considered. The Weyl–Carleman theory for eigenfrequencies of bounded-body oscillations is expounded. Methods for solving the inverse problems of scatterer identification are described. This theory is shown to be closely related to the ill-posed problems analyzed in a separate chapter. Numerical methods for the solution of irregular problems are also given in the concluding part. The book is recommended for senior students of physicomathematical and engineering specialties, postgraduates, and practising specialists and offers tools for creating new methods both analytical and numerical. (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

*Fundamental Space Studies* Vol. 1. *Astrophysics* (Sci. Ed. Doctor of Technical Sciences, Prof. G G Raikunov (Moscow: Izd-vo Fizmatlit, 2014) 452 pp. ISBN 978-5-9221-1549-0.
*Fundamental Space Studies* Vol. 2. *Solar System* (Sci. Ed. Doctor of Technical Sciences, Prof. G G Raikunov (Moscow: Izd-vo Fizmatlit, 2014) 456 pp. ISBN 978-5-9221-1559-9.

This two-volume monograph describes the problems of investigating astrophysical objects, solar–terrestrial relations, and the Solar System as a whole. Methods of their solution are proposed, and the basic principles of designing scientific apparatuses and space facilities are shown. The main results of research in our country and abroad are summarized. Tendencies in the development of these problems and the predicted evolution of space equipment up to 2050 are also discussed. Ways to solve technological problems in the design of promising space facilities are outlined. The monograph is intended for research workers and practising engineers — experts in the field of space technologies, as well as postgraduates and senior students in corresponding specialties. (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

**Volkov K N, Deryugin Yu N, Emel'yanov V N, Karpenko A G, Kozelkov A S, Teterina I V** *Methods for the Acceleration of Gas-Dynamical Calculations on Unstructured Grids* (Ed. by Prof. V N Emel'yanov) (Moscow: Izd-vo Fizmatlit, 2014) 536 pp. ISBN 978-5-9221-1542-1.

Methods for acceleration of an iteration convergence are developed based on geometrical and algebraic multigrid technologies, pre-conditioning the Navier–Stokes equations in simulation of low-velocity flows, and modification of the near-wall function method in calculations of turbulent flows. Discussed are the methods of acceleration of gas-dynamical calculations using parallelization and vectorization of calculations on massively parallel computers and general-purpose graphics processors, as well as methods of calculation domain decomposition and processor load balancing. The book will provide a valuable source of reference for specialists in the field of fluid and gas mechanics, computational gas dynamics, aerospace engineering, and power machine building, and for undergraduate and postgraduate students. (Fizmatlit Publ.: 117342 Moscow, ul. Butlerova 17B; tel. +7 (499) 968-92-28; e-mail: fizmat@maik.ru; URL:http://www.fml.ru/)

**Bogachev V I, Krylov N V, Rekner M, Shaposhnikov S V** *Fokker–Planck–Kolmogorov Equations* ('Mathematics and Mechanics' Series) (Izhevsk: Institute of Computer Studies, 2013) 592 pp. ISBN 978-5-4344-0154-8.

The modern theory of elliptic and parabolic equations for measures is systematically presented; typical examples are Fokker–Planck–Kolmogorov equations for probabilistic distributions. This book is intended for mathematicians and physicists whose research work deals with diffusion processes and who are involved with elliptic and parabolic equations. (Institute of Computer Studies: 426034 Izhevsk, ul. Universitetskaya 1; tel/fax: +7 (3412) 500-29-5; URL: http://shop.rcd.ru, http://ics.org.ru)

**Finkel'shtein A V** *Physics of Protein Molecules* ('Interdisciplinary Problems of Biology, Mathematics, Physics, Chemistry, and Medicine' Series) (Moscow: Institute of Computer Science, 2014) 202 pp. ISBN 978-5-4344-0193-7.

This book generalizes the results of fundamental research and, in particular, the author's studies on protein biophysics. It covers various aspects of protein molecule biophysics: from the classification and basic principles of organization of protein spatial structures (membrane, fibrillar, and, particularly, the best-investigated water-soluble globular proteins) to

the principles of protein functioning and arrangement of their active centers; from elementary interactions in proteins and protein–medium interactions to conformation transitions in proteins, polypeptides, and synthetic polymers. Great attention is paid to protein self-organization (both *in vivo* and, in particular, *in vitro*), intermediates (like the 'melted globule' discovered by O B Ptitsyn and his colleagues), protein folding nuclei, protein engineering and design, and the principles of protein structure coding by its amino acid sequence. This book is meant for a wide range of students, postgraduates, and research workers, namely, biologists, physicians, biochemists, and biophysicists. (Institute of Computer Studies: 426034 Izhevsk, ul. Universitetskaya 1; tel/fax: +7 (3412) 500-29-5; URL: http://shop.rcd.ru, http://ics.org.ru)

**Shuleikin V V** *Marine Physics* 5th edition. (Moscow: Izd-vo URSS, 2014) 1096 pp. ISBN 978-5-9710-1237-5.

The fourth (revised and enlarged) lifetime edition of this monograph was issued by Nauka Publishing House in 1968. This book is concerned with different problems of marine physics and includes the results of paramount, for the most part Soviet, research and also very significant foreign studies. The author touches upon the theory of sea current, tides and other long waves, the questions of thermics, optics, acoustics, and biological marine physics, the physical roots of climate and weather, etc. The chapter "Kinematics, dynamics, and calculation of wind waves" presents the results of domestic studies that laid the physical basis for computations and prognoses of wind wave elements by a given wind velocity, the time of its action, the distance from the windward boundary of the storm, and a given sea depth, i.e. for a given provision of waves. The chapter "Magnetic and electric phenomena in the sea" is devoted to phenomena which are of great interest in both theoretical and practical respects and require continuous experiments in the ocean and in closed seas. This book is basically meant for researchers in the field of marine physics, in related fields of geophysics and physical oceanography, experienced practitioners in marine observatories and marine expeditions, postgraduates, and senior students of the corresponding professions at universities and other higher educational institutions. (URSS Publishing group: 117335 Moscow, Nakhimovskii prospekt 56; tel./fax: +7 (499) 724-25-45; e-mail: urss@URSS.ru; URL: http://urss.ru/).

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