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New books on physics and related sciences: May 2023

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Marov M Ya, Shevchenko I I ***Exoplanets. Physics, Dynamics, Cosmogony*** (Moscow: Fizmatlit, 2022) 192 p. ISBN 978-5-9221-1955-9.

The book deals with the problems of physics, dynamics, and the cosmogony of extrasolar planets (exoplanets) and planetary systems. Exoplanets are the broadest new class of astronomical objects, the potential of whose investigation has only opened up since the end of the last century. Several thousand exoplanets have already been discovered in a little more than two decades owing to constantly improving methods of ground-based and especially space observations. Exoplanets are of paramount interest for astrophysical, cosmochemcal, and dynamic research. Solving the fundamental problems of stellar and planetary cosmology, primarily the problem of the origin and evolution of the solar system, has been put on a new scientific basis. The discovery of terrestrial-type planets, especially those located in orbital zones corresponding to climatic conditions favorable for the emergence and maintenance of life opens up new prospects for progress in astrobiology. The book is intended for researchers in a broad field of astronomy and astrophysics, planetology, and exoplanetology; it will also be useful to popularizers of science. The book can be used in the educational process in classical universities as a manual. The publication of the book was supported by grant 075-15-2020-780 of 13.1902.21.0039, ''Theoretical and experimental studies of the formation and evolution of extrasolar planetary systems and exoplanet characteristics'' from the Ministry of Science and Higher Education of the Russian Federation. (Publishing House Fizmatlit: tel. +7(495) 005-32-79; URL: http://www.fml.ru/, https://www.fmllib.ru/)

Serbo V G, Khriplovich I B ***Lectures on Quantum Mechanics*** (Ser. University textbooks and manuals) (Moscow–Izhevsk: Institute of Computer Science, 2023) 266 p. ISBN 978-5-4344-0984-1.

The book is based on the syllabus of the annual course of lectures on quantum mechanics for third-year students of the Physical Department of Novosibirsk State University and reflects the authors' many-year experience in delivering lectures and conducting seminars. The presentation of a range of issues is rather original. The standard material, which can be found in available textbooks, is described briefly and concisely. The book only contains the problems approved at seminars. It is intended for students, postgraduates, and teachers of physics and mathematics. (Institute of Computer Science: e-mail: ICSEditorial12007@gmail.com, URL: http://shop.rcd.ru/)

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Lisitsin S G ***Mechanics in the Course of General Physics. Theory and Solutions to Problems. Textbook*** (Dolgoprudnyi: Intellekt Publishing House, 2023) 288 p. ISBN 978-5-91559-308-3.

The textbook is intended for students of physical and technical specialties studying a general physics curriculum. Solutions to various sophisticated problems on all the main topics from the section ''Mechanics'' are considered. The clear and comprehensible presentation and the analysis of many original problems are based on the author's long experience at the technical university and the physico-mathematical lycée. The textbook is intended for university and lycée students. (Intellekt Publishing House: tel. +7 (495) 579-96-45, e-mail: id-intellect@mail.ru, zakaz@id-intellect.ru, URL: http://www.id-intellect.ru/)

Antonets I V, Shavrov V G, Shcheglov V I ***Waves in Multilayer Structures*** Part 1. ***Computing Methods: Direct, Averaging, Matrix*** (Moscow: Fizmatlit, 2022) 424 p. ISBN 978-5-9221-1958-0.

The monograph is devoted to presentations of the bases of methods for calculating one-dimensional and electromagnetic wave propagation through multilayer structures. The direct and averaging methods are used to determine the parameters of propagating waves, as well as the energy reflection and transmission coefficients. Considerable attention is paid to the matrix method, which has a quite universal character and allows a simple machine algorithmization for structures with an arbitrary number of layers. Several applied problems are solved. Many examples and methodical recommendations for students' independent work are given. The book is intended for specialists working in wave process physics, electrodynamics, and magnetic phenomena, and for engineers and designers of microwave, optical, and acoustic equipment, as well as for students and postgraduates of relevant specialties. (Publishing House Fizmatlit: tel. +7(495) 005-32-79; http://www.fml.ru/, https://www.fmllib.ru/)

Galenko P K, Ankudinov V E, Starodumov I O ***High-speed Dynamics in the Phase Field Method: Microscopics*** 2nd edition, stereotyp. (Ser. Phys.) (Moscow–Izhevsk: Institute of Computer Science, 2022) 240 p. ISBN 978-5-4344-0972-8.

The monograph presents a model of a crystal phase field, developed to describe fast phase transitions from the liquid to the solid state. Rapidly moving fronts in the transfer from metastable and unstable to stable or metastable states are analyzed on the basis of space-time averaging of the equation of nonequilibrium dynamics with memory. The hyperbolic model of a crystal phase field, allowing for the wave character of phase transformations, is considered as an example for

describing fast transitions. The ideas and formalism formulated in the book can be applied to describe a wide class of structural phase transformations in materials under extreme conditions (e.g., under fast cooling, under laser annealing, in samples deeply supercooled and intensely irradiated with high-energy beams). The book will be useful to students, postgraduates, and scientists working with multiscale problems in the field of the physics of materials and applied mathematics. (Institute of Computer Science: e-mail: ICSEditorial12007@gmail.com, URL: http://shop.rcd.ru/)

Burmistrov S N ***Fundamentals of Statistical Physics and Physics of the Condensed State*** (Dolgoprudnyi: Intellekt Publishing House, 2023) 416 p. ISBN 978-5-91559-314-4.

The book outlines the basic elements of statistical physics and physics of the condensed state. The material was largely selected on the basis of the author's personal experience and preferences with allowance for the program of statistical physics of the basic course of theoretical physics at the Moscow Institute of Physics and Technology. Sergei Nikolaevich Burmistrov is a doctor of physical and mathematical sciences, associate professor of the Department of Theoretical Physics at MIPT, and a leading researcher at the National Research Center Kurchatov Institute. The book is primarily addressed to students and postgraduates of higher educational institutions studying statistical physics as one of the three main courses of theoretical physics: field theory, quantum mechanics, and statistical physics proper. The book can also be used as a supplement to the available manuals on statistical physics and physics of the condensed state. (Intellekt Publishing House: tel. +7 (495) 579-96-45, e-mail: id-intellect@mail.ru, zakaz@id-intellect.ru, URL: http://www.id-intellect.ru/)

Rubin A B (Ed.) ***Horizons of Biophysics*** (On the 270th anniversary of M V Lomonosov Moscow State University) (Ser. Interdisciplinary issues of biology, mathematics, physics, chemistry, and medicine) (Moscow–Izhevsk: Institute of Computer Science, 2022)
Vol. 1. ***Molecular biophysics. Medicine biophysics*** 456 p. ISBN 978-5-4344-0963-6.
Vol. 2. ***Cell biophysics. Ecological biophysics*** 376 p. ISBN 978-5-4344-0964-3.

Biophysics is an interdisciplinary field of science, rapidly developing at the interface of biology, physics, chemistry, and mathematics. The materials presented reflect the prospects of the development of the main branches of this science, namely, molecular biophysics, membrane biophysics, biophysics of photobiological processes, bioenergetics, biophysics of cell processes, and ecological and medical biophysics. The results obtained in recent years by biophysicists at M V Lomonosov Moscow State University and the Russian Academy of Sciences are considered. The data presented concern the theoretical foundations of modern biophysics and their application for solving fundamental and applied problems of contemporary biology. The book is intended for a wide range of scientists and practitioners and graduate and postgraduate students specializing in areas where the biophysical approach can be useful in studying living systems and solving problems in medicine, biotechnology, ecology, and alternative energy. (Institute of Computer Science: e-mail: ICSEditorial12007@gmail.com, URL: http://shop.rcd.ru/)

Burov V A, Rumyantseva O D ***Inverse Wave Problems of Acoustic Tomography*** Pt. 4 ***Functionally analytical methods for solving a multidimensional acoustic inverse scattering problem*** (Moscow: URSS, 2023) 504 p. ISBN 978-5-9710-3991-4.

Inverse wave problems and their applied aspects related to linear and nonlinear acoustic tomography and acoustic thermotomography are considered. The main results of studies carried out at the Laboratory of Inverse Problems at the Acoustic Department of M V Lomonosov Moscow State University over several recent decades are summarized. The book is divided into four parts that are interrelated to a certain extent. Each chapter presents theoretical aspects of a problem, and the prospects of application are discussed. Part 4 is devoted to the application of the rigorous methods of functional analysis for solving acoustic inverse problems of scattering and to the results of simulations obtained for the first time. These studies are based on results obtained earlier as solutions to inverse problems of quantized field scattering by potentials well localized in space. (Publishing Group URSWS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: hppt://urss.ru/)

Bulyubash B V ***Joule and Others*** (Moscow: Association of scientific editions KMK, 2023) 113 p. ISBN 978-5-907533-87-5.

Joule and Others is the first biographical book in the Russian language that depicts the life and work of the English Victorian physicist James Prescott Joule, one of the three most widely known authors of the energy conservation law: Mayer (1842), Joule (1843), and Helmholtz (1847). Joule's name was immortalized as a unit of work, energy, and the amount of heat (1 joule, 1 J) as far back as 1889 and is now known to everyone who has held a food package in their hands, on which the energy value is now necessarily indicated in joules and/or calories. However, the life path of J P Joule is little known to a wide range of readers, especially Russian speakers. The presented book fills in the blanks. It emphasizes the atypical figure of Joule, who did not study at a university but had a laboratory at his disposal with unique temperature measuring instruments, equipped by Joule's father, the owner of a brewery, where Joule was employed full-time and could only do science in his spare time. The well-known scientist John Dalton was invited to be a tutor for the son, who trained J P Joule at least a year and a half. The book has 7 chapters, each presenting Joule's activity in the context of activities of 'other' scientists: Michael Faraday, William Thomson, John Tyndall, Robert Mayer, and others. In particular, Faraday's remarks in reviewing an article submitted by Joule for possible publication in one of the editions of the London Royal Society (LRS) are analyzed. A special place in the book is given to William Thomson (the future baron Kelvin), who did not hide his interest in Joule's work, which prompted the scientific community (which for some time did not accept the work of a 'nonprofessional') to reconsider its attitude towards Joule's scientific work. The priority dispute around Joule's work is also described in detail. The dispute was started by R Mayer, who declared that he (and not Joule) had been the first to estimate the mechanical equivalent of heat. At first,

the discussion was not long: albeit with reservations, Joule admitted the rectitude of R Mayer, whose results had been published before Joule's. The result of the discussion, which covered a decade and a half, was recognition by the scientific community of Mayer's special contribution to the formation of the energy conservation law. The informal status of Mayer, Helmholtz, and Joule as the 'chief' authors of the energy conservation law was reinforced by the award of the Copley Medal — the most prestigious award of LRS — to all three of them. The final chapter of the book presents Joule's measurements related to the project of creating (under the guidance of James Maxwell) the 1-Ω resistance standard. Such a standard was, in particular, needed to establish a stable telegraph connection between Europe and the USA. Joule's results did not agree with the data of Maxwell's team. Joule's assumption that Maxwell's team data were overestimated were decisively rejected by Thomson. The situation could only be rectified by Lord Raileigh, who became director of the Cavendish Laboratory after Maxwell's death. Namely, he carried out a double-check (including the measurements of Maxwell's group) and, in fact, confirmed Joule's rightness. The book also describes the cohesion and influence of the scientific community, which convinced the Government of Her Majesty to grant Joule a state pension. The book is intended for all those interested in the history of scientific ideas and the life of the makers of science. (Publishing House Association of Scientific Editions KMK, e-mail: info@avtor-kmk.ru, URL: http://avtor-kmk.ru).

Prepared by
M S Aksenteva (e-mail: maria@ufn.ru)
E V Zakharova (e-mail: elena.zakharova.office@gmail.com)