

New books on physics and related sciences

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Bogolyubov N N *Collected Scientific Works* in 12 volumes ('The Classics of Science' Series, compiled and edited by A D Sukhanov) *Mathematics and Nonlinear Mechanics* in 4 volumes: Vol. 1 *Mathematics, 1925–1990* (Eds V S Vladimirov and A D Sukhanov), Vol. 2 **Bogolyubov N N, Krylov N M** *Nonlinear Mechanics, 1932–1940* (Eds Yu A Mitropol'skii and A D Sukhanov), Vol. 3. **Bogolyubov N N, Mitropol'skii Yu A** *Asymptotic Methods in the Theory of Nonlinear Oscillations* (Eds Yu A Mitropol'skii and A D Sukhanov), Vol. 4. *Nonlinear Mechanics, 1945–1974* (Eds Yu A Mitropol'skii and A D Sukhanov) (Moscow: Nauka, 2005–2006) [Vol. 1 — (2005) 775 pp. ISBN 5-02-034463-X; Vol. 2 — (2005) 828 pp. ISBN 5-02-034089-8; Vol. 3 — (2005) 605 pp. ISBN 5-02-033942-3; Vol. 4 — (2006) 432 pp. ISBN 5-02-034141-X]

This is the first time the scientific works of N N Bogolyubov, a classic figure in mathematics and natural science, have been published this completely. Planned as a twelve-volume set, the edition is unique in that its constituent contributions have never been published together before.

Volume 1 is concerned with Bogolyubov's works that pioneered new directions in a number of fields (the theory of differential equations, variational calculus, the theory of the trigonometric approximation of functions) and were instrumental in how mathematical physics developed into what it is today.

The second volume presents the outstanding contributions of Bogolyubov and N M Krylov to nonlinear mechanics — four monographs and several major papers that develop new mathematical methods and apply them to the solution of specific engineering problems.

The third volume reprints the text of the famous monograph by Bogolyubov and Yu A Mitropol'skii, which went through four Russian editions — the last, in 1974, has long been difficult to find — and which was translated into major foreign languages.

Included in the fourth volume is postwar work — in particular, the unique book *On Some Statistical Methods in mathematical Physics* and two lectures "The method of integral manifolds in nonlinear mechanics" and "On quasiperiodic solutions to problems of nonlinear mechanics" — where the ideas of nonlinear mechanics are applied and further developed into what can be called theoretical physics tools.

This four-part work of reference will be a useful source for undergraduate and postgraduate students, researchers, practising engineers, and faculty in mathematics, mathematical physics, and nonlinear mechanics, as well as for mathematics and mechanics historians. (The Russian Academy of Sciences Publishing Center 'Nauka': 117997 GSP-7 Moscow V-485, Profsoyuznaya ul. 90; tel. (7-495) 334-71-51;

fax: (7-495) 420-22-20; e-mail: secret@naukaran.ru; URL: <http://www.naukaran.ru/>)

Anishchenko V S, Vadivasova T E, Shimanskij-Gajer L *Oscillating Systems in Dynamical and Statistical Terms* (Moscow–Izhevsk: RKhD, 2005) 156 pp. ISBN 5-93972-414-0.

The book covers the fundamentals of the theory of deterministic and stochastic nonlinear systems and those of the classical theory of periodic oscillation synchronization. The material of the book can serve as a brief introduction to nonlinear dynamics and synergetics. The book is designed for undergraduate and postgraduate students and faculty in natural science fields and can be used as a textbook in universities. (Science and Publishing Center 'Regular and Chaotic Dynamics': 426034 Izhevsk, ul. Universitetskaya 1, Udmurt State University; tel. (7-3412) 50-02-95, (7-495) 332-48-92; e-mail: subscribe@rcd.ru; URL: <http://www.shop.rcd.ru/>)

Rudenko O V *Nonlinear Acoustics: Topical Reviews and Related Applications* (Moscow: Izd-vo 'Regional'naya obshchestvennaya organizatsiya uchenykh po problemam prikladnoi geofiziki', 2006) 423 pp., ISBN 5-90163616-3.

The collection under review realizes the author's goal of introducing modern nonlinear acoustics through a series of review papers written in different years and on different topics. Each review is self-contained and can be read independently of the others. The 'made-simple' articles 2.1 and 2.2 published in the journal *Priroda* (Nature) can be recommended as a general introduction to the subject. Comparing the 1974 review paper 1.8 with the later *Physics-Uspekhi* papers 1.1–1.4 provides insight into how the field of nonlinear acoustics evolved — by broadening its scope and putting more emphasis on its applied aspects. Along with reviews, the book also includes a small number of original papers which are schematically divided into the following sections: 3. Mathematical physics, nonlinear models; 4. Biophysics, medicine; 5. Nonlinear optics and optoacoustics; 6. Geophysics, nonlinear diagnostics; 7. Hydro- and gas dynamics, nonlinear systems with moving boundaries, and 8. Nonlinear wave beams, resonators. These papers were conceived to demonstrate the relationship of 'pure' nonlinear acoustics to the allied sciences of mathematics, biophysics, nonlinear optics, geophysics, and mechanics. For this purpose, the most recent publications were selected, as well as those whose results have already found applications in a diversity of fields. None of these papers was reflected either in monograph literature or in the reviews of topical problems included in Sections 1 and 2 of the collection, nor they are highly specialized engineering papers. Section 4 presents several examples of how high-intensity ultrasound finds application in biology and medicine (see also reviews 1.5 and 1.6). This field is currently developing at a very fast rate;

practically all ultrasonic therapy devices and many diagnostic devices operate in the nonlinear regime, and the world market for these devices amounts to billions of dollars — all this suggesting that a separate monograph should be written on the subject. Also, a considerable expansion of Section 5 is worth considering. Some of the author's works on optoacoustics have already appeared in the monograph *Laser Optoacoustics* written by Professors A A Karabutov (Moscow State University) and V E Gusev (now in France), both formerly the authors' postgraduate students, and so are not included here. Section 6 is in fact fully based on recent work. It should be noted that nonlinearity effects manifest themselves very strongly and in a wide variety of research areas in geophysics. The objects in geophysics are sufficiently complex, not reducible to simple and well-studied nonlinear models, and have thus far been only poorly studied — which allows one to hope for new and interesting results in the near future. This section thematically overlaps with the review 1.1. Finally, traditionally close links between nonlinear acoustics and mechanics, particularly gas dynamics and hydrodynamics, are emphasized in Section 7. It is hoped that the reader with enough time to skim through this collection will agree that nonlinear acoustics is wider in scope and more practically significant than he or she previously thought. (Public regional academic organization for applied geophysics' Publ.: 123810 Moscow, ul. B Gruzinskaya 10; tel./fax (7-495) 254-90-80)

Menskii M B *Man and the Quantum World (Oddities of the Quantum World and the Mystery of the Mind)* (Seriya 'Nauka dlya vseh' ('Science for All' Series) (Fryazino: Vek-2, 2005) 320 pp. ISBN 5-85099-161-1.

Quantum mechanics — perhaps the most exciting subdiscipline in physics — is discussed from three different viewpoints in the three parts of this book. Part 1 expounds the history of creation of quantum mechanics and covers its basic ideas that emerged as the customary classical world outlook was being painstakingly revised. Using several impressive examples from various fields (superconductivity and superfluidity, lasers, nanotechnology, quantum informatics), modern engineering applications of quantum mechanics are illustrated. Part 2 points to the yet-to-be-resolved conceptual problems (paradoxes) of quantum mechanics. It is shown that an attempt to resolve these problems leads to the concept of parallel worlds (the so-called Everett's interpretation) which, when logically extended, leads in turn to new insights into the phenomenon of consciousness, explaining its extraordinary capabilities that are seemingly at odds with physical laws. Two Appendices to the book present the fundamentals of the modern quantum measurement theory, including the theory of decoherence, and discuss several problems related to entangled states (quantum correlation), including Bell's theorem and the principles of quantum informatics. (Vek-2 Ltd, Publ.: Fryazino, Moscow region, P.O. Box 107; e-mail: vek-2@mail.ru; URL: <http://www.vek2.nm.ru/>)

Danilov Yu A *Lectures on Nonlinear Dynamics: An Elementary Introduction* ('Synergetics: from the past to the future' Series) 2nd ed. (Moscow: Editorial URSS, 2006) 208 pp. ISBN 5-901095-08-1.

The textbook evolved from lectures which the author, a prominent scientist, educator, and science popularizer Yulii

Aleksandrovich Danilov, delivered in the Chemistry Department at M V Lomonosov Moscow State University, during the 'Nonlinear days for the young' at N G Chernyshevskii Saratov State University, at the Moscow Engineering Physics Institute, and at a number of universities in Western Europe. The book provides detailed coverage of a wide range of topics, including discrete mappings and the theory of continuous systems; chaotic behavior; fractal theory and power laws, and synergetics and ergodic theory. Distinctly real-practice oriented (with all its formulas presented in a user-friendly form) and meticulously exact in presenting major concepts (which usually go without definitions), this is a valuable reference source for undergraduate and postgraduate students in physics, mathematics, biology, and chemistry, as well as for those interested in the state-of-the-art of the science that treats of the behavior of complex systems of various nature (from physical through social to economic, etc.) (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-495) 135-44-23, 135-42-16; e-mail: urss@urss.ru; URL: <http://www.urss.ru/>)

Gas Dynamics. Selected Works (Ed. by A N Kraiko) in 2 volumes: Vols 1 and 2; 2nd revised ed. (Moscow: Fizmatlit, 2005) [Vol. 1 — 720 pp. ISBN 5-9221-0651-1; Vol. 2 — 752 pp. ISBN 5-9221-0650-3].

The collection includes abridged versions of TsIAM (Central Institute of Aircraft Mechanical Engineering) Gas Dynamics Laboratory research papers of 1950–2000. Topics covered in the first volume include quasi-1D models; the problems of boundary layer and its separation; hypersonic flows; optimal aerodynamic shaping; optimal shaping of gas dynamic bearings; the stability and aeroacoustics of channel flows; interaction of gratings and rims, and nonstationary compression of gas. The second volume is concerned with detonation wave flows; numerical techniques; transonic flows; turbulent jets; theories and models of turbulence; two-phase flows; MHD flows; electrogasdynamic turbulent flows in channels and jets; coronal discharge in a gas stream, and contactless electrostatic diagnostics. The collection will appeal to anyone with an interest in the past and future of gas dynamics. (Fizmatlit Publ.: 117997 Moscow, Profsoyuznaya ul. 90; tel. (7-495) 334-74-21; fax (7-495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Vergeles S N *Lectures on Quantum Electrodynamics* (Moscow: Fizmatlit, 2006) 248 pp. ISBN 5-9221-0634-1.

This is a textbook on the fundamentals of quantum electrodynamics. The first part uses very simple examples to formulate the method of functional integration and to introduce the basic concepts of quantum field theory. The second part presents seven lectures on quantum electrodynamics per se in which, in particular, a number of observable effects are calculated rigorously in the one-loop approximation. The third part can be considered as an optional supplement to a semester lecture course. Fifty or so exercises and problems effectively complement the text. The intended audience for this set of lectures is undergraduate and postgraduate students in theoretical physics and faculty who lecture and conduct seminars on the fundamentals of quantum field theory. (Fizmatlit Publ.: 117997 Moscow,

Profsoyuznaya ul. 90; tel. (7-495) 334-74-21; fax (7-495) 334-76-20; e-mail: fizmat@maik.ru; URL: <http://www.fml.ru/>)

Gorobets B S *Landau: A Circle of Life* (Moscow – St.-Petersburg: Izd-vo Letnii Sad, 2006) 656 pp. ISBN 5-98856-004-0.

An absorbing account of the life and career of the physicist whose contributions include the theory of phase transitions, the theory of superfluidity, the density matrix method, the discoveries of the diamagnetism of electrons in metals and of ‘frictionless’ wave damping in plasma, and much more. A Soviet scientific genius and Nobel laureate in Physics 1962 for his pioneering theories for condensed matter, the founder of the world’s strongest tradition of theoretical physics, and the author (with E M Lifshitz and L P Pitaevskii) of a multi-volume theoretical physics course which was translated into more than 20 languages, Academician L D Landau (1908–1968) lived through a succession of triumphs and tragedies. An international celebrity at 20; married to — or rather practising his free-love theory with — the most beautiful woman of the then Ukrainian capital of Khar’kov; a pioneer in the struggle against ‘military-applied physics’ in the Khar’kov Physical–Technical Institute — the struggle that eventually led to the forced dissolution of the institute and to the arrest and firing of a number of its scientists; held in a secret police (NKVD) prison for a year for preparing anti-Stalinist leaflets, before being released through the intervention of P L Kapitza; Hero of Socialist Labor and laureate of three Stalin Prizes for his atomic and hydrogen bomb calculations, and at the age of 54, a victim of a car accident, indifferent to life and science, and with only 6 more years to live. The author examines the personality of Landau: his candidness, his unwavering commitment to and pursuit of truth, his rationalism and system-mindedness, egocentrism and authoritarianism. The book contains a popular-scientific exposition of main Landau’s achievements in physics and features a separate section in which his mistakes are also discussed based on available data from the literature. Included in the book are essays on the prominent members of the Landau scientific school: E M Lifshitz and I M Lifshits, A S Kompaneets, A B Migdal, V L Ginzburg, A A Abrikosov, and I M Khalatnikov. The archival material in the Appendix contains declassified documents from the case files of the physicists L V Shubnikov and L V Rozenkevich who were executed by firing squad; the interrogation records of Landau; shorthand records (provided by the KGB) of his wiretapped conversations and of denunciations of him; a lecture devoted to him by E M Lifshitz, and some other evidences. (Letnii Sad Publ.: 197136 St.-Petersburg, Pet St, Bol’shoi prosp. 82; tel. (7-812) 232-21-04; fax (7-812) 233-19-62; e-mail: letnysad@mail.wplus.net).

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