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New books on physics and related sciences

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Rubakov V A Classical Gauge Fields: Bosonic Theories 3rd ed. (Moscow: LIBROKOM, 2010) 296 pp. ISBN 978-5-397-01359-8.

The basis of this book is a course of lectures delivered to the third- and fourth-year undergraduate students specializing in theoretical physics at the Physics Department of Moscow State University. The book consists of two parts. The first contains a summary of the principal ideas of the gauge field theory, the methods of constructing gauge-invariant Lagrangians, and the description of the spectra of linear excitations, including excitations above the nontrivial ground state. The second part of the book is devoted to constructing and interpreting those solutions whose existence stems entirely from the nonlinearity of the field equations-that is, solitons, Euclidean bubbles, instantons, and sphalerons. The material in the book can be mastered in parallel with the study of quantum mechanics, then quantum field theory. In view of this, the volume would be useful to researchers, postgraduate students, and university students in the senior year. (Knizhnyi dom LIBROKOM Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9; tel./fax (7-499) 135-44-23; e-mail: orders@URSS.ru; URL: http://www.urss.ru/)

Anishchenko V S, Astakhov V V, Vadivasova T E Regular and Chaotic Self-Oscillations: Synchronization and the Effect of Fluctuations (Moscow: Intellekt, 2009) 312 pp. ISBN 978-5-91559-066-2.

Oscillatory processes are ubiquitous throughout nature, in technology, and in society, and represent one of the most important subjects of research in science. Undamped oscillations in nonlinear dissipative systems, to which A A Andronov gave the name 'self-oscillations', are of special interest. This book describes and analyzes self-excited oscillations in dynamical systems with a finite number of degrees of freedom. This volume is a textbook and a monograph at the same time. It includes the necessary information from the modern theory of dynamical systems, which provides the basis for understanding the material in the book. Classical results concerning the Van der Pol oscillator as a selfoscillating system with one degree of freedom are presented in detail. A description is given of generators with 1.5 and 2 degrees of freedom, which implement not only periodic, but also quasiperiodic and random oscillations. Classical results of the theory of synchronization of periodic oscillations in radio physics are described in detail, and the problem of synchronization of quasiperiodic and random oscillations is

discussed. Special emphasis is placed in the book on the analysis of the role of fluctuations affecting self-oscillating systems. The classical theory of fluctuations in generators of periodic oscillations is given. The statistical characteristics of fluctuations in the generators of chaotic signals are outlined. The book describes fluctuations' impact on the synchronization effects. The authors attempted to describe the results of the classical theory of oscillations with maximum completeness, having also covered the role of fluctuations, which are typically hard to digest for students. At the same time, the book includes descriptions of more complex types of selfoscillations, such as quasiperiodic and chaotic, which are the subject of research today. The book is intended for a wide range of readers, from undergraduate students to high-level specialists who study oscillatory processes in the natural environment and in modern technology. It can be recommended as a textbook for students of classical and technical universities. (Izdatel'skii dom Intellekt Publ.: 141700 Dolgoprudnyi, Moskovskaya obl., Promyshlennyi proezd 14; tel. (7-495) 408-76-81; e-mail: lfs@id-intellect.ru; URL: http://www.id-intellect.ru/)

Doroshenko V A, Kravchenko V F Diffraction of Electromagnetic Waves by Open Conical Structures (Ed. V F Kravchenko) (Moscow: FIZMATLIT, 2009) 272 pp. ISBN 978-5-9221-0966-6.

This monograph describes methods for solving the problems of diffraction of electromagnetic waves by open conical structures, developed on the basis of theoretical studies, mathematical modeling, and the analysis of the generation of electromagnetic fields by objects with characteristic angular parameters and geometric singularities (vertices, edges). A mathematical technique was suggested for solving the nonstationary problem of diffraction of electromagnetic waves by a complex-shaped conical surface with longitudinal slots, without a priori restrictions on the geometric dimensions of the structure. Reliable information about the features, patterns, and physical nature of the effects emerging in the diffraction of electromagnetic waves by complex unclosed conical surfaces was obtained as a result of model testing. The book is intended for researchers, practising engineers, and postgraduate, graduate, and undergraduate students engaged in the problems of diffraction of electromagnetic waves by open conical structures. Reviewers: Academician V I Pustovoit, Doctor of Physical and Mathematical Sciences A D Shatrov. (Publishing company Fizikomatematicheskaya literatura MAIK Nauka/Interperiodika: 117997 Moscow, ul. Profsoyuznaya d. 90; tel. (7-495) 334-74-21; fax: (7-495) 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fml.ru/)

Uspekhi Fizicheskikh Nauk **180** (7) 783–784 (2010) DOI: 10.3367/UFNr.0180.2010071.0783 Translated by V I Kisin

Kolobov M I (Ed.) *Kvantovoe izobrajenie.* [Kolobov M I (Ed.) Quantum Imaging.] (Translated from English by T Yu Golubeva, Ed. A S Chirkin) (Moscow: FIZMATLIT, 2009) 328 pp. ISBN 978-5-9221-1191-1.

The monograph was written by an international group of authors (leading experts in quantum optics). It presents the most important results of theoretical and experimental research obtained in the framework of the all-European QUANTIM project. Quantum imaging is a new area of quantum optics; it investigates the limiting characteristics of optical images admissible by quantum mechanics. The book is devoted mainly to the transformation of optical images in various nonlinear optical systems using the quantum features of radiation generated by parametric light sources. It examines the aspects of forming an optical image and its processing and detection, at a sensitivity and resolution going beyond the limits of the classical image; it discusses various aspects of quantum fluctuations in spatial solitons, the orbital angular momentum of light, and its applications in optical communications. The book is intended for professionals working in the field of optics and informatics and interested in quantum aspects. It will be useful to postgraduate and undergraduate students of corresponding specialties. Translation of the English edition: Kolobov M I (Ed.) Quantum Imaging (New York: Springer, 2007) xiv, 316 pp. (Publishing company Fiziko-matematicheskaya literatura MAIK Nauka/Interperiodika: 117997 Moscow, ul. Profsoyuznaya d. 90; tel. (7-495) 334-74-21; fax: (7-495) 334-76-20; e-mail: fizmat@maik.ru; URL: http:// www.fml.ru/)

Evseev I V, Rubtsova N N, Samartsev V V Coherent Transient Processes in Optics (Moscow: FIZMATLIT, 2009) 536 pp. ISBN 978-5-9221-1199-7.

The monograph formulates the physical principles of the formation of optical coherent transient processes in gases and in doped solid-state materials. The main focus is on the phenomenon of photon echo and photon-echo spectroscopy. The bulk of the book is devoted to the coherent optical spectroscopy of gaseous media. The last chapter of the monograph, dealing with the echo spectroscopy of doped solid-state materials, illustrates the differences between the methods of coherent spectroscopy adjusted for gaseous and solid-state media. Considerable attention is given to the development of photon echo processors, including quantum processors. This monograph can be used as a textbook for undergraduate and graduate students of physics departments of state universities. It is also addressed to a wide range of professionals and postgraduate students in the field of coherent optics and quantum electronics. Reviewers: Professor N V Znamenskii, DSc, Director of the Institute of Superconductivity and Solid State Physics (ISFTT) of the RRC 'Kurchatov Institute' (Moscow); V A Zuikov, DSc, Leading Researcher of the Kazan Physical-Technical Institute (KFTI) of the KSC RAS (Kazan). (Publishing company Fiziko-matematicheskaya literatura MAIK Nauka/Interperiodika: 117997 Moskva, ul. Profsoyuznaya d. 90; tel. (7-495) 334-74-21; fax: (7-495) 334-76-20; e-mail: fizmat@maik.ru; URL: http:// www.fml.ru/)

Tolmachev V V, Skripnik F V *Physical Principles of Electronics* (Moscow: Regular and Chaotic Dynamics Publ., Institute of Computer Studies, 2009) 464 pp. ISBN 978-5-93972-735-8.

This textbook outlines at an elementary level the foundations of quantum mechanics and quantum statistics needed to understand the quantum theory of semiconductors, which underlies the solid-state electronics. The textbook also presents in detail the basic aspects of the physics of semiconductor devices, including the diode with a pn junction and the pnp transistor. The manual is intended for the second- and third-year students of technical colleges and universities studying courses of solid-state electronics, as well as for anyone interested in the basics of solid-state electronics. (Scientific 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: subsc-ribe@rcd.ru; URL: http://shop.rcd.ru/)

Chernavskii D S Synergetics and Information: Dynamic Theory of Information 3rd enlarged ed. (Moscow: LIBRO-KOM, 2009) 304 pp. ISBN 978-5-397-00207-3.

The book discusses the features of the science of synergetics and its mathematical and methodological aspects. Processes of the origin of information and the evolution of information's value are outlined. The origin of life and genetic code, the problem of development of the organism, and the processes of thinking and creativity are discussed as examples. Mathematical modeling is widely used. To facilitate perception, a brief presentation of the foundations of the theory of dynamical systems is given in a manner accessible for people without special mathematical training. The book also discusses the application of synergetics to describing historical events. A separate chapter is devoted to the informational nature of money. The book is intended for a wide range of readers interested in new trends in modern science and in the questions of the integration of accurate and descriptive natural sciences and humanities. (Knizhnyi dom LIBROKOM Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9; tel./fax (7-499) 135-44-23; e-mail: orders@URSS.ru; URL: http://www.urss.ru/)

Vilenkin A Mir Mnogikh Mirov: Fiziki v Poiskakh Parallelnykh Vselennykh [Vilenkin A Many Worlds in One. The Search for Other Universes] (Series 'Elements', Translated from English by A Sergeev) (Moscow: CORPUS–Astrel, 2010) 304 pp. ISBN 978-5-271-25401-7.

We all live among the remnants of a huge explosion that took place about 14 billion years ago and laid the foundation of our Universe. However, what preceded this grand event? And what is the probability that other worlds exist somewhere in addition to ours? In this popular book written by a physicist, Tufts University professor Alex Vilenkin (USA) introduces the reader to the latest scientific achievements in cosmology and expounds his own theory attempting to prove the possibility — more than that, to calculate the probability of the existence of countless parallel universes. The conclusions implied by his hypothesis are staggering: a multitude of other worlds, some similar to ours, others fundamentally different from it, lie beyond its borders; they are inhabited by unimaginable beings, or by human beings indistinguishable from us. Vilenkin's ideas proved to be so clear, so convincing, and at the same time so revolutionary, that they turned a modest ivory-tower scientist, virtually overnight, into a star of popular talk shows, and his book into an international bestseller having enormous public resonance. Translation of

the English edition: A Vilenkin *Many Worlds in One. The Search for Other Universes* (New York: Hill and Wang, 2007). (Publishing Group AST: tel. (7-495) 615-01-01, fax (7-495) 615-51-10; e-mail: astpub@aha.ru; URL: http://www.ast.ru/)

Derbyshire J Prostaya Oderzhimost: Bernkhard Riman i Velichaishaya Nereshennaya Problema v Matematike (Prime Obsession: Bernhard Riemann and the Greatest Unsolved Problem in Mathematics (Series 'Elements', Translated from English by A M Semikhatov) (Moscow: CORPUS–Astrel, 2010) 463 pp. ISBN 978-5-271-25422-2.

How many prime numbers not greater than 20 are there? The answer is eight: 2, 3, 5, 7, 11, 13, 17, and 19. And how many prime numbers are there not exceeding a million? Is there a general formula that could save us counting them one by one? The conjecture put forward by the German mathematician Bernhard Riemann in 1859 became an idée fixe for many generations of scientists: elegant, intuitively clear, and at the same time completely unprovable, it remains one of the greatest unsolved problems in modern mathematics. It is no accident that the Clay Mathematics Institute included the Riemann hypothesis among the seven "Millennium Prize Problems" with a million dollars allocated for the solution to each problem. A popular and witty book by the American mathematician and publicist John Derbyshire tells the story of numerous attempts at proving (or disproving) the Riemann hypothesis over the past 150 years, and also of the fates of people obsessed with this idea. The book won the prestigious Euler Prize for a popular exposition of a mathematical problem. Translation of the English edition: J Derbyshire Prime Obsession: Bernhard Riemann and the Greatest Unsolved Problem in Mathematics (London: Plume, 2003). (Publishing Group AST: tel. (7-495) 615-01-01; fax (7-495) 615-51-10; e-mail: astpub@aha.ru; URL: http:// www.ast.ru/)

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