Physics – Uspekhi **46** (11) 1225 – 1227 (2003)

PACS number: 01.30.Tt

New books on physics and related sciences

DOI: 10.1070/PU2003v046n11ABEH001763

Boĭko V I, Skvortsov V A, Fortov V E, Shamanin I V ***Interaction of Pulsed Charged Beams with Matter*** (Moscow: Fizmatlit, 2003) 288 pp. ISBN 5-9221-0326-1.

This monograph is a result of the authors' many years of work at MFTI, Tomsk Polytechnic Institute, and the Joint Institute for High Temperatures, RAS — a 'fusion' of sorts of the creative efforts of the Moscow and Tomsk scientific schools of physics. The book by no means duplicates known publications on the title theme but, on the contrary, complements them in a natural way by focusing on the dynamics of how transitions to extreme states (including those of a strongly nonideal plasma) occur under the action of intense pulsed beams of charged particles. The book not only brings together information dispersed over the authors' numerous journal publications and conference reports but also presents their original, relatively new findings. The book will be of interest for a wide range of specialists, both young (newcomers, including undergraduate and postgraduate students) and those already with a fair amount of experience in the field. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fizmatlit.ru/)

Akhmediev N N, Ankevich A ***Solitons: Nonlinear Pulses and Beams*** (Moscow: Fizmatlit, 2003) 304 pp. ISBN 5-9221-0344-X.

A monograph written by noted nonlinear optics specialists presents a broad review and systematization of both theoretical work on soliton light pulses and three-dimensional optical solitons and how they are applied in fiber communication lines and optical switching devices. Along with classical and contemporary works by authors from Russia and abroad, many original results of the authors themselves are employed in the book. It contains abundant graphic material obtained by mathematical simulation and numerical calculations. A particular feature of the book is its accessible presentation style, which makes it useful not only to specialists in the fields of nonlinear optics and mathematical physics but also to practising engineers in optoelectronics, postgraduate students, and senior undergraduate students. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax (7-095) 334-74-21, 334-76-20; e-mail: fizmat@ maik.ru; URL: http://www.fizmatlit.ru/)

Uspekhi Fizicheskikh Nauk **173** (11) 1263 – 1264 (2003)
Translated by E G Strel'chenko

Landau L D, Rumer Yu B ***What is Relativity Theory?*** (SO RAN Popular Science Series) (Novosibirsk: Izd. SO RAN, 2003) 122 pp. ISBN 5-7692-0585-7.

The popular science book by two prominent physicists — L D Landau (Academician, Nobel laureate, and Lenin prize winner) and Professor Yu B Rumer — is an engaging and accessible account of the theory of relativity, a rather difficult subject to understand for a wide range of readers. At present there are already no doubts that the structure of the world is in complete agreement with this theory, and our everyday practice only increases further our confidence in the absolute nature of its ideas. Although the theory of relativity describes seemingly familiar phenomena, it requires additional intellectual efforts to be understood. Stories of the paradoxes of relativity theory are complemented by biographical essays on L D Landau and Yu B Rumer. The book will be useful to senior pupils and junior undergraduates, to teachers, and to a broad spectrum of readers. (SB RAS Publ.: 630090 P.O. box 187, Novosibirsk, Morskoĭ prosp. 2; tel./fax (7-3832) 30-17-58; fax (7-3832) 33-37-55; e-mail: sprice@ad-sbras.nsc.ru; URL: http://www.psb.ad-sbras.nsc.ru/)

Ostrovskiĭ L A, Potapov A I ***Introduction to the Theory of Modulated Waves*** (Moscow: Fizmatlit, 2003) 400 pp. ISBN 5-9221- 0370-9.

This book examines linear and nonlinear waves which, in a broad sense, can be placed in the class of modulated waves. Examples of wave processes in electrodynamics, plasma physics, acoustics, hydrodynamics, and elasticity theory are discussed. The space – time analogues of methods applied in geometrical optics and 'quasi-optics' are described. Other topics include the propagation of modulated waves in nonstationary media; quasi-harmonic waves in highly dispersive and weakly nonlinear media, when modulation shows up as slow amplitude and frequency changes in space and time; parametric soliton amplification in the field of a traveling wave, and the soliton – soliton interaction. Considerable attention is given to the interaction of solitons as classical particles whose motion is governed by Newton type equations. A comparison is made of exact and approximate methods used to describe soliton interactions. Historical background is discussed, and problems for personal study are included. Although the book is intended for senior undergraduate, master-degree, and postgraduate students, specialists in a variety of fields may also find it interesting. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fizmatlit.ru/)

Astapenko V A, Fomichev A A *Coherent Processes and Interference Effects in Laser Physics* (Moscow: Fizmatlit, 2003) 104 pp. ISBN 5-7417-0209-0.

This textbook reviews the physics of and descriptive methods for a number of coherent processes and interference effects that arise when mono- or bichromatic laser radiation interacts with matter. To mathematically describe coherent phenomena, the formalism of the optical Bloch vector is employed, providing a clear picture of the processes under discussion. Intended for undergraduate and postgraduate students specializing in the fields of laser physics and quantum electronics (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax (7-095) 334-74-21, 334-76-20; e-mail: fizmat@maik.ru; URL: http://www.fizmatlit.ru/)

Baranov A A, Kolpashchikov V L *Relativistic Thermomechanics of Continua* 2nd ed. (Moscow: Editorial URSS, 2003) 152 pp. ISBN 5-354-00401-2.

This monograph summarizes advances in the investigation of the thermomechanics of continua at relativistic velocities. It addresses the problems of the relativistic thermomechanics of continuous media — the study of the behavior of matter in strong electromagnetic and gravitational fields, when relativistic magnetic hydrodynamics, electrohydrodynamics, and the post-Newton hydrodynamics of the general theory of relativity should be systematically applied. Solutions for a number of special but nonetheless important problems are given. Intended for research workers, theoretical physicists, and specialists in mechanics, it can also be useful to senior students in related disciplines. The book's concise presentation style is in part compensated for by references to a vast bibliography — which does not claim to be exhaustive, though. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Chikhachev A S *Kinetic Theory of the Quasi-Stationary States of High-Current Charged Beams* (Moscow: Fizmatlit, 2001) 176 pp. ISBN 5-9221-0151-X.

Results of theoretical investigations into quasi-stationary nonlaminar flows of charged particles are presented in this book. The book examines what states of a uniform beam can be realized at the output of an accelerating system, and how the transition from a large- to a small-cross-section beam can be performed (the so-called compression problem). To analytically describe the variety of physical situations related to the formation of nonlaminar flows, model solutions of self-consistent kinetic equations are employed. Other topics include problems concerning the state of beams in a residual gas, the self-consistent description of nonstationary ellipsoidal bunches of particles, and the stability of the earlier studied stationary flow configurations. For research workers, postgraduates, and senior undergraduates specializing in the physics of beams, the theory of accelerators, and plasma physics. (Fiziko-Matematicheskaya Literatura & MAIK Nauka/Interperiodika Publishing: 117997 Moscow, Profsoyuznaya ul. 90; tel./fax (7-095) 334-74-21, 334-76-20; e-mail: fizmat@ maik.ru; URL: http://www.fizmatlit.ru/)

Samarskiĭ A A, Vabishchevich P N *Computational Heat Transfer* (Moscow: Editorial URSS, 2003) 784 pp. ISBN 5-354-00234-6.

The book addresses state-of-the-art numerical methods applied to tackle heat transfer problems. Basic approaches to investigating mathematical heat transfer models analytically by using traditional applied mathematics tools are described. Numerical methods for approximately solving stationary and nonstationary heat conduction problems in many dimensions are discussed. Special attention is given to phase transformation, thermoelasticity, and radiative heat transfer problems, as well as to heat and mass transfer processes. Optimization and control problems relating to thermal processes are discussed, and the numerical solution of inverse heat exchange problems is considered. For a variety of two-dimensional heat transfer problems, examples are given of how computer programs can be utilized to find solutions. The book is primarily targeted at specialists — both present-day and prospective — in mathematical modeling. A specific area of applied studies may in fact be far away from heat transfer problems as such. Heat transfer problems, on the one hand, are widely encountered, and corresponding mathematical models are rather completely worked out. On the other hand, mathematical heat transfer models are so diverse that they can be considered prototypical for numerous classes of applied studies. The book first appeared in 1995 in English. It was published by J Wiley Inc., under the title *Computational Heat Transfer* (Vol. 1 — *Mathematical Modelling*, Vol. 2 — *The Finite Difference Methodology*). The book is intended for undergraduate and postgraduate students in applied mathematics departments of universities, and for practising specialists in mathematical modeling. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Bogush A A *Introduction to the Gauge Field Theory of Electroweak Interactions* 2nd ed. (Moscow: Editorial URSS, 2003) 360 pp. ISBN 5-354-00436-5.

This book provides a systematic and accessible presentation of the fundamentals of the classical (no secondary quantization) field theory of elementary particles and their electromagnetic and weak (electroweak) interactions. The fields of massive and massless free particles with spins 0, 1, and 1/2 are briefly described. The major points of departure and crucial stages in the construction of Weinberg – Glashow – Salam's gauge theory of electroweak interactions are discussed. A simple scheme based on the Green function method and perturbation theory for the treatment of electromagnetic and weak processes in the framework of classical field theory is considered and applied. A unified matrix formulation of the proposed theory of free and interacting fields is given. The material of the book constitutes the content of special lecture courses in the theory of classical fields and the gauge theory of interactions, which have been delivered by the author for more than two decades in the Physics Department of V I Lenin Belorussian State University. Mathematical supplements and numerous worked examples are an integral part of the book. Intended for researchers, teachers and lecturers, and undergraduate and postgraduate students. Can be used as a textbook for readers not particularly knowledgeable about

this field. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

Amel'kin V V ***Differential Equations in Applications*** 2nd ed. (Moscow: Editorial URSS, 2003) 208 pp.

A popular introduction to the possibilities that ordinary differential equations offer in the study of real processes and phenomena. Mathematical procedures employed in constructing differential equations, and some methods used to qualitatively study such equations are illustrated by problems that arise in various areas of knowledge. For senior pupils, teachers, undergraduate university and college students, and for specialists in nonmathematical disciplines who are involved with mathematics in their work. (Editorial URSS Publ.: 117312 Moscow, prosp. 60-letiya Oktyabrya 9, office 203 at the RAS Institute for Systems Analysis; tel./fax (7-095) 135-44-23, 135-42-46; e-mail: urss@urss.ru; URL: http://www.urss.ru/)

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