

New books on physics and related sciences

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Frank I M *Scientific proceedings*. In 2 books. Books 1, 2. (Moscow: Nauka, 2018). Book 1: 478 p. ISBN 978-5-02-040044-3, Book 2: 670 p. ISBN 978-5-02-040110-5.

This collection of scientific works by the outstanding physicist, Nobel Prize laureate Il'ya Mikhailovich Frank, contains papers from various years selected according to the subject matter. The first book includes papers of 1931–1935 on fluorescence and photochemical reactions, as well as papers on the optics of light sources moving in refractive media, including papers devoted to the theory of Vavilov–Cherenkov radiation and the Doppler effect in a refractive medium. Articles on the prediction and study of transition radiation occupy significant space. The last section of the book completely reproduces I M Frank's monograph, “Izluchenie Vavilova-Cherenkova. Voprosy teorii” (Vavilov–Cherenkov radiation. Theoretical questions). The second book consists of four sections. The first includes papers on nuclear physics, and the second, on reactor physics. The third part is devoted to neutron optics and ultracold neutron physics, and review papers, reports at conferences, and popular scientific articles are included in the fourth section. The book is intended for physicists, students, postgraduates of physical specialties, and historians of science. (Nauka publishers: +7(495) 276-77-35, e-mail: info@naukaran.com, URL: <https://naukapublishers.ru/>).

Krasnikov N V, Matveev V A *New physics at the Large Hadron Collider*. (Moscow: URSS, 2014) 208 p. ISBN 978-5-396-00629-4.

The book presents a review of the most important directions in the search for new physics in forthcoming experiments at the Large Hadron Collider (LHC) constructed by the international union of scientists and specialists from many countries on the basis of the European Organization for Nuclear Research in Geneva, known as CERN. The book mainly focuses on the search for the Higgs boson underlying the mechanism of spontaneous violation of gauge symmetry of electroweak interactions. Moreover, the search for supersymmetry and a number of other exotic phenomena predicted by different generalizations of the Standard Model of elementary particles is discussed in detail. The book was written for researchers — both theoreticians and experimentalists — specialists in modeling physical processes in high-energy particle collisions in modern colliders, and all those studying elementary particle physics, high-energy physics, and quantum field theory. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>).

Krasnikov N V, Matveev V A *Discovery of the Higgs boson and the search for new physics at the Large Hadron Collider at energies of 7 and 8 TeV*. (Moscow: URSS, 2015) 288 p. ISBN 978-5-396-00645-4.

This book presents a review of the most important directions in the search for new physics in 2010–2012 Large Hadron Collider (LHC) experiments at a total colliding proton energy of 7 and 8 TeV. The LHC was constructed by the international union of scientists and specialists from many countries on the basis of the European Organization for Nuclear Research in Geneva (CERN). The book gives a review of the search for the Higgs boson underlying the mechanism of spontaneous violation of gauge symmetry of electroweak interactions. Furthermore, also reviewed is the search for supersymmetry and the related new family of heavy fundamental particles and a number of exotic phenomena predicted by different generalizations of the Standard Model of elementary particles. The book will be of interest to researchers — both theoreticians and experimentalists — postgraduates and students studying elementary particle physics, high-energy physics, and quantum field theory, and specialists in the field of modeling physical processes in high-energy particle collisions in modern colliders. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>).

Bitjukov S I, Krasnikov N V *The use of statistical methods for the search for new physics at the Large Hadron Collider*. (Moscow: URSS, 2019) 272 p. ISBN 978-5-396-00910-3.

This book presents a review of statistical methods used in the search for new physics in experiments at the Large Hadron Collider (LHC). Numerous examples are given that will be useful for physicists engaged in processing data from LHC detectors. The book is intended for researchers, both theoreticians and experimentalists; for specialists in modeling physical processes in high-energy particle collisions at modern colliders; and for all those interested in obtaining physical results from experimental data. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>).

Gorbunov D S, Rubakov V A *Introduction to the theory of the early Universe: Cosmological perturbations. Inflation theory* (Moscow: URSS, 2022) 568 p. ISBN 978-5-9710-9331-2.

The content of the book is to a great extent based on the relation between cosmology and microworld physics. Results are presented concerning the theory of development of cosmological perturbations, inflation theory, and the postinflationary heating theory. Considered are both the existing concepts of the early and contemporary Universe and the most developed and grounded — but still not experimentally confirmed — theoretical models. Methods of nonequilibrium statistical physics and more special methods of quantum field

theory are considered in several sections. Necessary information is given in appendices to facilitate the comprehension of these sections. The book is a continuation of the monograph, *Introduction to the theory of the early Universe. The theory of a hot Big Bang* (Moscow: URSS), presenting the results concerning a homogeneous isotropic Universe at the hot stage of its evolution and at consequent cosmological stages. The book will be of use to researchers, postgraduates, and students specializing in elementary particle physics and cosmology. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>).

Gorbunov D S, Rubakov V A *Introduction to the theory of the early Universe. The theory of a hot Big Bang*. (Moscow: URSS, 2020) 616 p. ISBN 978-5-9710-7166-2.

The content of this book is to a great extent based on the relation between cosmology and microworld physics. The results are presented concerning a homogeneous isotropic Universe at the hot stage of its evolution and at consequent cosmological stages. The main sections consider the accepted notions of the early and contemporary Universe; these sections may serve as a contemporary introduction to this rapidly developing area of science. Necessary information from the General Relativity Theory and the elementary particle theory are given in the appendices to make reading the main sections easier. Moreover, hypotheses (often alternative) are discussed that concern yet unsolved problems of cosmology, such as dark matter, dark energy, and matter-antimatter asymmetries. The book will be interesting to science workers, postgraduates, and students specializing in elementary particle physics and cosmology. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>)

Sobolewski N M *Monte Carlo method in problems of particle-matter interaction*. (Moscow: Fizmatlit, 2017) 208 p. ISBN 978-5-9221-1723-4.

This textbook is based on a lecture course delivered by the author to students at the Moscow Institute of Physics and Technology (MIPT) over ten years. The aim of the course was an accessible presentation of the technique of Monte Carlo simulations as applied to problems of particle-matter interaction, and also of some sections of the probability theory and mathematical statistics minimally necessary for practical application of the method. The textbook can also be of use to postgraduates and science workers as an introductory course on this topic. (Fizmatlit publishers: tel. +7 (495) 005-32-79; URL: <http://www.fml.ru/>, <https://www.fmlib.ru/>).

Rubakov V A *Classical gauge fields: Boson theories*. Part 1. (Series: Classical textbooks of MSU) 5th edition, revised and considerably expanded (Moscow: URSS, 2020) 344 p. ISBN 978-5-9710-7238-6.

The book is based on a lecture course delivered to third- and fourth-year students in the Physical Department of Lomonosov Moscow State University (MSU) specializing in theoretical physics. The book consists of two parts. The first contains the main ideas of gauge field theory, the construction of gauge-invariant Lagrangians, and a description of the spectra of linear excitations, including a nontrivial ground state. The second part is devoted to the construction and

interpretation of solutions whose existence is totally due to the nonlinearity of field equations—solitons, ‘Euclidean bubbles’, instantons, and sphalerons. This material can be studied in parallel with quantum mechanics and then quantum field theory. In this connection, the book will be useful to science workers, postgraduates, and senior university students. In the course of preparing the fifth edition, the book was considerably revised. In addition to specifications and expanding some sections, several new sections and two supplements were added at the end of the book. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>).

Rubakov V A *Classical gauge fields: Theories with fermions. Noncommutative theories*. Part 2. (Series: Classical textbooks of MSU) 6th edition (Moscow: URSS, 2020) 240 p. ISBN 978-5-9710-7240-9.

This book is based on a lecture course delivered to third- and fourth-year students in the Physical Department of Lomonosov Moscow State University (MSU) specializing in theoretical physics. Considered in the first part of the book are various effects due to fermion interaction with topological objects appearing in theories of scalar and gauge fields—solitons, instantons, and sphalerons. Less traditional material concerning classical field theories in noncommutative spaces and solitons in such theories is discussed in the second part. The book contains a supplement briefly discussing the role of instantons as saddle points of the Euclidean functional integral in quantum field theory and some related issues. This material can be studied in parallel with quantum mechanics and then with quantum field theory. In this connection, the book should be helpful to science workers, postgraduates, and senior university students. (Publishing group URSS: tel./fax: +7 (499) 724-25-45, e-mail: orders@URSS.ru, URL: <http://urss.ru/>)

Stern B, Rubakov V A *wonderful science*. (Moscow: ACT, Vremena, 2020) 366 p. ISBN 978-5-17-111648-4.

This collection of popular scientific papers published in the newspaper *Troitskii variant — Nauka* (Troitsk version — Science) in various years presents discussions of interesting facts about space and the particle microworld, namely, dark energy, cosmological inflation, black holes, exoplanets, the Higgs boson, relic radiation, the Big Bang, and baryon asymmetry. To make it easier to understand the material, the authors supplemented the collection with several specially written articles and comments on earlier papers. The authors of the book are leading experts of the popular scientific portal *Troitskii variant — Nauka*—the theoretical physicist, specialist in quantum field theory, elementary particle physics, and cosmology, chief research fellow of the Institute for Nuclear Research RAS (INR RAS), editor-in-chief of the journal *Uspekhi Fizicheskikh Nauk (Physics—Uspekhi)*, academician of the Russian Academy of Science (RAS), V A Rubakov, and the astrophysicist, leading research associate of INR RAS, editor-in-chief of the newspaper *Troitskii variant — Nauka*, doctor of physical and mathematical sciences, B E Stern. The book is intended for a wide range of readers. (ACT publishers: e-mail: ask@ast.ru, URL: <https://ast.ru/>).

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