

New Books from North-Holland

Laser Handbook

Edited by **F. T. Arecchi**, Center for Information on Experimental Studies, Milan and **E. O. Schulz-Dubois**, IBM Research Laboratory, Zurich

Contents: Part A: Photon Statistics (*R. J. Glauber*). Theory of Laser Operation (*M. Sargent III and M. O. Scully*). The Theory of Coherence, Noise and Photon Statistics of Laser Light (*H. Haken*). Optical Resonators (*L. Ronchi*). Measurement of the Statistical Properties of Optical Fields (*F. T. Arecchi and V. Degiorgio*). Part B: Gaseous Lasers: Atomic, Molecular and Ionic (*C. K. Rhodes and A. Szöke*). Solid Ion Lasers (*R. B. Chesler and J. E. Geusic*). Liquid Lasers (*F. P. Schäfer*). Semiconductor Lasers: Theory (*F. Stern*). Semiconductor Lasers: Devices (*H. Kressel*). Part C: Design of a Solid-State Laser (*H. F. Mahlein and D. Roess*). Techniques of Solid-State Lasers (*O. Svelto*). Techniques of High-Power Light-Pulse Amplification (*P. G. Kriukov and V. S. Letokhov*). Design Considerations of Lasers (*J. P. Goldsborough*). Techniques of Gas Lasers (*O. P. McDuff*). Modulation Techniques (*R. T. Denton*). Demodulation Techniques and Photodetectors (*H. Melchior*). Optical Parametric Oscillators (*R. G. Smith*). Optical Coatings and Thin-Film Techniques (*E. Ritter*). Part D: Nonlinear Optical Materials (*S. K. Kurtz*). Electro-Optic Materials (*S. H. Wemple*). Elasto-Optic Materials (*D. A. Pinnow*). Magneto-Optic Materials (*W. J. Tabor*). Part E: Linear Scattering from Thermal Fluctuations (*H. Z. Cummins and P. E. Schoen*). Stimulated Rayleigh, Brillouin and Raman Spectroscopy (*W. Kaiser and M. Maier*). Self-Focusing and Self-Defocusing and Self-Modulation of Light Beams in Nonlinear Media (*R. V. Khokhlov, S. A. Akhmanov and A. P. Sukhorukov*). Optical Harmonic Generation in Nonlinear Media (*D. A. Kleinman*). Nonlinear Coherent Resonant Phenomena (*E. Courtens*). Two-Photon Spectroscopy (*J. M. Worlock*). Lasers in the Investigation of High-Temperature and Plasma Phenomena (*O. N. Krokhin*). Raman Spectroscopy of Solids (*A. Mooradian*). Part F: Lasers in Metrology (*A. Sona*). Holography (*J. C. Viénot*). Lasers in High-Speed Photography (*G. V. Sklizkov*). Material Processing (*M. I. Cohen*). Laser Applications to Computers (*N. G. Basov, W. H. Culver and B. Shah*). Optical Information Processing (*R. V. Pole and K. S. Pennington*). Laser Ranging (*M. L. Sticht*). Optical Communication Theory (*E. V. Hoversten*). Laser Applications to Biology and Medicine (*D. E. Rounds*).

1972, 2 volumes, approx 1800 pp., in prep.

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This high price presumably reflects the costs involved in setting and printing the journal articles instead of reproducing them. If the book is truly planned for students, why did Pergamon not issue a simultaneous soft-covered edition, as they did for the reprint volume *Men of Physics: L. D. Landau, Vol. I*, which sells for \$2.95?

It is interesting to compare *Helium 4* with the AIP Selected Reprints series, where the papers are reproduced photographically from the original journals. This procedure is much cheaper, and the AIP volume *Liquid Helium* (edited by Cecil Lane) costs only \$2.50. Furthermore, the two books contain many identical papers. Although the AIP book lacks much of the theoretical work, it does include the original notes by Fritz London and Laszlo Tisza along with four experimental papers from the 1960's. In view of the high price of *Helium 4*, a thrifty student would be better advised to order the Selected Reprint volume *Liquid Helium* (Department BN, American Institute of Physics) and supplement it with the above mentioned soft-covered edition of Landau's selected works, thereby saving \$4.05 and gaining six more of Landau's papers.

ALEXANDER L. FETTER
Stanford University

High-Intensity Ultrasonic Fields

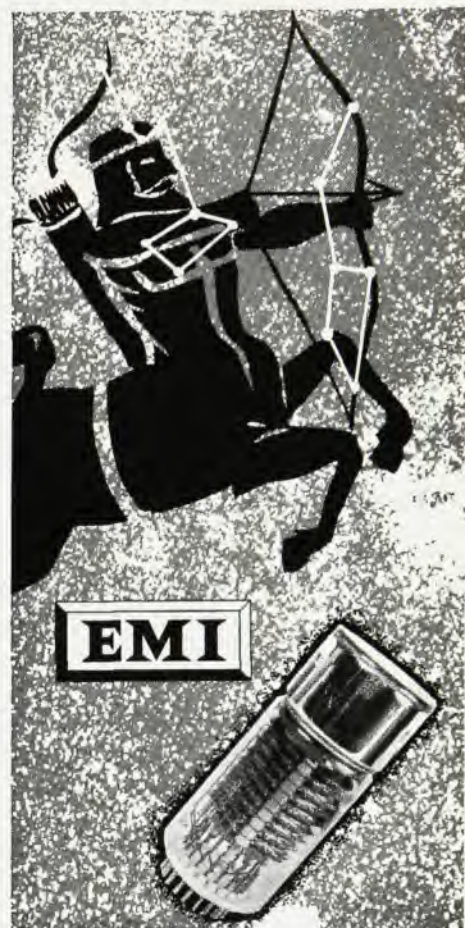
L. D. Rozenberg, ed.
429 pp. Plenum, New York, 1971. \$30.00

This book consists of six parts written by experts in different areas of high-intensity sound, nonlinear absorption of sound, acoustic radiation pressure, acoustic streaming and ultrasonic cavitation. This last topic accounts for a little more than one-half of the book.

The editor, the late Lazar Davidovich Rozenberg, an outstanding leader of Soviet ultrasonic research, worked for 15 years in the broad field of physical ultrasonics at the Acoustics Institute of the Academy of Sciences in Moscow. The material in the book is based, to a large extent, on the work by him and his many students and research associates at the Institute. He was Chairman of the Scientific Council on Ultrasonic Physics and Engineering of the Academy and was intimately involved in the coordination of research and industrial development projects in many organizations and institutes in the Soviet Union.

It does not take much experimentation with sound to realize that nonlinear effects are present and often quite pronounced. These effects are not limited to ultrasound; they occur at audible frequencies as well. The dust

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By MASATAKA MIZUSHIMA
University of Colorado

This is a unified treatment of all important fields of theoretical physics—Green's functions for almost all fields, spinors for classical and quantum relativity, metric tensor treatment in special and general classical relativity and quantum mechanical relativity, and group theoretical treatment of atomic, molecular, nuclear, and elementary particle physics.

The text reviews core material including classical mechanics, mechanics of continuous bodies, electricity and magnetism, special and general relativity, quantum mechanics, relativistic quantum mechanics, atomic and molecular physics, and high energy physics.

It explains and applies extensively the mathematics of Green's functions, complex analytic functions, group theory, and others. It cites experimental works in all fields, including electricity and magnetism and general relativity. Includes numerous exercises and problems plus values of important physical constants.

1972 In press

GRAVITATION AND COSMOLOGY: PRINCIPLES AND APPLICATIONS OF THE GENERAL THEORY OF RELATIVITY

By STEVEN WEINBERG
Massachusetts Institute of Technology

This is an introduction to general relativity and cosmology that's modern in both content and philosophy. The starting point is Einstein's Principle of Equivalence. Geometric concepts aren't introduced until a solid physics foundation is laid.

The text covers the most recent work on applications and experimental implications as well as the fundamentals of general relativity.

The section on modern cosmology contains the most recent available observational data. There's a complete up-to-date discussion of experimental tests of general relativity and frequent references to relationships between general relativity and elementary particle physics. And the text covers topics not usually covered, like tetrad formalism, Killing vectors, post-Newtonian approximation, and theory of differential forms. 1972 In press

SCATTERING THEORY

By JOHN R. TAYLOR, University of Colorado

This text covers all the important aspects of the non-relativistic theory, including many computational techniques. Every concept—Moller operators, S operator, on- and off-shell T matrices—are first introduced in their simplest context. Then the text moves from the simple case to the general. This makes the theory easier to understand and the notation simpler.

The central approach to the scattering theory is based on the modern time-dependent method. This leads quickly and naturally to the idea of the scattering operation S and the text centers on the properties of S. This approach provides a more comprehensive introduction for students, plus greater rigor.

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PHYSICS: The Behavior of Particles

PHILIP STEHLE
University of Pittsburgh

This noncalculus introductory physics text for students of biology, premedicine, architecture, and the liberal arts surveys classical and modern physics through the study of the behavior of particles both individual and in groups. Discussions are based on Newton's Laws of Motion, modified to include relativistic mechanics where needed, quantum ideas, and experimental observation. *Combined Answer Book and Instructor's Manual.* 1971. 434 pp.; \$10.95.

AN INTRODUCTION TO THE MEANING AND STRUCTURE OF PHYSICS

LEON N COOPER
Brown University

The Original Edition: Especially written for nonscience majors, this text does not require calculus. All the classical topics (mechanics, heat, light, electricity, magnetism) are examined before modern physics is introduced. Generalizations and abstractions of more advanced concepts follow. This approach integrates fundamental ideas of physics within the setting of their historical development. "Clearly an excellent text."—*Physics Today*. 1968. 746 pp.; \$13.95.

The Short Edition: Abridged and slightly revised, the Short Edition covers nearly all the same topics but excludes some of the more technical illustrations and simplifies more difficult parts of the exposition. 1970. 535 pp.; \$12.95.

COLLEGE PHYSICAL SCIENCE, Second Edition

VADEN W. MILES
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Wayne State University

For the nonscience major, this text presents fundamentals and recent developments in physics, astronomy, chemistry, and geology, using the study of physics as the central framework. *Instructor's Manual.* 1969. 530 pp.; \$10.95.

LABORATORY STUDIES IN THE PHYSICAL SCIENCES

GEORGE MORIBER
ISIDORE HUDES
Brooklyn College

This laboratory manual for either a one-semester or a one-year physical science survey course for the nonscience major covers experiments in physics, chemistry, astronomy, and geology. Includes detailed introductions to each experiment, historical background material, tear-out data recording sheets, and many review exercises. 1971. Paper. 269 pp.; \$4.95.



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pattern in a Kundt's tube, which is related to the existence of static pressure gradients and steady circulations induced by the sound field, is a familiar example. At ultrasonic frequencies, with readily achieved beaming and focusing of sound, many other effects can be seen, even with relatively low-power transducers: radiation pressure, cavitation, atomization of liquids, emulsification, agglomeration of particles, and so on. Although many of these effects have found their way into various industrial applications and scientific devices, the basic mechanisms involved have not always been fully understood.

The present book, focusing on the physics involved, serves to fill the need for a better understanding of the often quite complex acoustical nonlinear phenomena. Aimed primarily at scientists and engineers working in the field of ultrasonics, it provides an excellent, up-to-date review of topics of current interest. Some sections of the book, particularly those dealing with the absorption of finite-amplitude waves and acoustic radiation pressure, should also be suitable for assigned readings in graduate courses in general acoustics.

The section on acoustic streaming, a somewhat more specialized topic, deals with acoustically induced steady flow and vorticity in a fluid. A rather well known example is the flow produced in the vicinity of transducers ("Quartz Wind"), but other types of streaming are also discussed and analyzed mathematically in some detail. A considerable portion of the experimental results on acoustic streaming and nonlinear absorption has been obtained at audio frequencies, and the section on radiation pressure, of course, is not restricted to any particular frequency range. Therefore, it might have been justified to replace the word "ultrasonic" by "sound" in the title of the book.

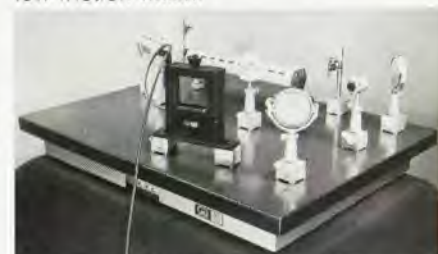
Acoustically induced cavitation in liquids, a topic that has received much attention in the acoustic literature, is the subject of the remaining half of the book. Aspects that are discussed in great depth include the generation and dynamics of a single cavitation bubble or void, the sound emission related to cavitation, the experimental techniques involved, the interaction between bubbles, and the behavior of aggregates of cavitation bubbles. It is interesting to note that the presence of cavitation bubbles alters the average compressibility and speed of sound in the liquid, and this acoustic effect should be somewhat analogous to the change of the index of refraction known to occur in nonlinear optics.

The treatment throughout the book is thorough, and the style is lucid, with excellent qualitative descriptions sup-

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PRINCIPLES OF PHYSICS, Second Edition

Frederick Bueche, University of Dayton
1972, 675 pages (tent.), (008825-X), \$11.95 (tent.)

The second edition continues to present the major topics of physics to students of diverse backgrounds, interests, and degrees of mathematical sophistication. Much purely descriptive general science material is omitted, leaving the "physics" of the course intact. The new text includes a reorganized discussion of statics (with torque deferred to later chapters) and a new chapter on the origin of the universe. Modern physics concepts are introduced wherever possible, but separate chapters are included to unify and extend this material. Despite rigorous restriction to major principles and their more important applications, however, enough material of practical importance remains to maintain student interest. Numerous exercises reinforce understanding of principles, and training in qualitative physical reasoning is induced by thoughtful questions or class discussion and order of magnitude calculations (called "guestimates"). Mathematics is introduced and augmented in careful steps.

CONTEMPORARY PHYSICS: An Introduction for the Non-Scientist

Jerome Pine, California Institute of Technology
1972, 416 pages (tent.), (050071-1), \$12.50 (tent.)

Written primarily for the non-science student, this text explicates some of the basic discoveries of physics, emphasizing atoms, nuclei, and their constituents. Both the substance of modern physics and the thought processes of the physicist are examined through quantitative discussion and problem-solving with a minimum of mathematical intricacy. Relying essentially upon arithmetic and a small but vital amount of elementary algebra, the book uses graphs whenever possible to illustrate mathematical relations. It also covers the main topics of classical mechanics and electromagnetism and such "modern" subjects as quantum mechanics and its applications to atomic and nuclear physics, relativity, and the applied physics of semiconductors and conductor devices. The first half of the book covers fundamentals; the second explores special topics based on an understanding of those fundamentals.

ELEMENTS OF PHYSICS, Eighth Edition

Alpheus W. Smith, and John N. Cooper, U.S. Naval Postgraduate School
1972, 674 pages (tent.), (058631-4), \$11.95 (tent.)

This text is designed for students having a broad range of technological and professional interests but lacking calculus. Extensive treatment of classical physics (mechanics, heat and thermodynamics, light, wave motion and sound, and electricity and magnetism) and ten chapters of modern physics provide these students with a thorough introduction to the fundamental laws and concepts of the field. This edition has been considerably reorganized and new material has been added in several areas, including sections on lasers and masers, the Hall effect, semiconductor physics, and the Coriolis acceleration. Emphasizing applications in such fields as medicine, biology, and engineering (in addition to physics itself), all problems from previous editions have been reworked and new ones added. Although sufficient for three-semesters, the text is easily adaptable for use in a two-semester course.

RELATIONSHIPS IN PHYSICAL SCIENCE

Wilfred F. Croft, Orman L. Wilson, and George A. Page, all of Central Connecticut State College

1972, 128 pages, (013920-2), \$2.95

Consisting of 23 experiments, this laboratory manual is designed for use in a physical science survey course emphasizing physics and chemistry. The student is encouraged to search for and find the relationships involved in an event rather than try to reproduce precisely the usually accepted "correct" quantitative answer. For each topic selected, the authors suggest a preliminary discussion or simple introductory experiment. They then present a more sophisticated laboratory method of investigation. To assist the search for relationships, questions are strategically placed throughout the experiment. Graphical analysis is utilized wherever possible to promote visualization of relationships for the nonmathematically oriented student. One year of high school algebra is prerequisite.

AN INTRODUCTION TO MODERN OPTICS

Ajoy K. Ghatak, Indian Institute of Technology, New Delhi

1972, 368 pages, (023156-7), \$11.00

Unorthodox in presentation, this book is given neither to excessive mathematical formalism nor to pure description. It represents a new approach to the study of optics. Dr. Ghatak deals with the principles of physical optics in the context of their relevance and relation to other branches of physics, incorporating a treatment of a number of recent developments. The detailed coverage of wave concepts notwithstanding, the relationship of the wave picture to the ray theory and quantum theory is neatly elucidated. Modern developments such as lasers and holography are also discussed.

EXPERIMENTS IN MATERIALS SCIENCE

E. C. Subbarao, Indian Institute of Technology at Kanpur; Marshal F. Merriam, University of California at Berkeley; V. Raghavan, Massachusetts Institute of Technology; Dipankar Chakravorty and L. K. Singhal, both of the Indian Institute of Technology at Kanpur/*McGraw-Hill Series in Materials Science*

1972, 288 pages, (062269-8), \$9.95

Designed to be used with any of the available texts in this field, this volume establishes the structure-property relationships in materials, and introduces the student to the experimental tools and techniques employed in the characterization and study of materials. Thirty relatively simple experiments are offered so that the instructor may choose the most appropriate ones according to the level and orientation of his students, and the facilities available. Methodically organized, each experiment includes: (1) the theory necessary to understand the concepts and interpret the results, (2) the equipment required, (3) a brief outline of the procedure, (4) the results to be obtained, (5) questions to be answered, and (6) references.

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plemented with concise mathematical analysis. Numerous line drawings and photographs add to the clarity of the presentation.

This fine book should be of interest not only to the acoustic specialist, but also to any serious student of the broad field of fluid physics.

UNO INGARD

Massachusetts Institute of Technology

Theoretical Magnetofluidynamics

By H. Cabannes.

(Trans. by M. Holt.)

233 pp. Academic, New York, 1970. \$12.50

Magnetofluidynamics is the study of conducting fluids moving through electromagnetic fields. The bulk motions of highly conducting fluids such as liquid metals, thermonuclear fusion plasmas and ionized gases of cosmic dimension can be described approximately by the magnetofluiddynamic equations of motion. However, in many practical situations the approximations are inadequate, and numerous efforts are now being made to improve the original magnetofluiddynamic equations by including multifluid and nonequilibrium effects associated with multiple temperatures, partial ionization, radiative losses and so on.

Henri Cabannes developed this book from his lectures given at the University of Paris. The present book is the English translation of the 1969 edition. It contains a very readable summary of classical material abstracted from several decades of research papers, monographs and texts, with only a few references covering the past five or six years.

The magnetofluiddynamic equations of motion are formulated from a macroscopic point of view in the first chapter. The notation and derivation are clear, but discussion of the range of application of the final equations is rather sparse. For instance, the possibility of tensor transport coefficients is mentioned nowhere, nor is the limitation to relatively low frequency phenomena considered.

By the second chapter the author has committed the reader to a rather mathematical point of view. The treatment of propagation of small disturbances is concise and is followed by a discussion of simple waves based on the theory of characteristic manifolds. All experimental information, technical applications and research problems have purposefully been omitted. Unfortunately there is also less physical reasoning than one would expect from material presumably selected to help develop a student's physical intuition

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