

tation only for some spin-1 mesons. This objection is recognized and the Yang-Mills apparatus is removed in the last paper (Ne'eman), which should therefore also be read first. But a related idea of how a Lie algebra enters dynamics, now of current-density operators in Hilbert space and their commutation relations, is proposed to clarify the weak interaction. A parity-conserving weak current vector is drawn in 8-dimensional $SU(3)$ space, and a similar parity-violating

one in another $SU(3)$ space; even $SU(6)$ appears briefly on page 203. Prior knowledge of theoretical reduction of the weak interactions is useful here.

There is a minimum of debate on assignment of resonances, probably thanks to the Ω^- . The nuclear physics is 3 pages where Oakes tells us that the deuteron belongs to a $\overline{10}$.

The papers on genesis of symmetry breaking are sketchy reviews of dark calculations. Perhaps the clearest is

"Octet Enhancement," formally non-leptonic weak, but with remarks on the electromagnetic and nonsymmetric strong interactions.

The book is not a mathematics book, and presumes extensive knowledge of the experimental situation; yet it is a bargain.

* * *

Elihu Lubkin, formerly of Brown University, was recently appointed associate professor at the University of Wisconsin—Milwaukee.

Recapturing the excitement

THE FEYNMAN LECTURES ON PHYSICS. Vol. 3: Quantum Mechanics. By Richard P. Feynman, Robert B. Leighton, Matthew Sands. 21 chapters. Addison-Wesley, Reading, Mass. 1965. \$6.75

by R. Bruce Lindsay

One of the most important duties of physicists is to insure their succession by the teaching of their discipline to the young. The most appropriate way of introducing the new student to the fundamental ideas of physics has been the subject of much experimentation over the years, and has resulted in the writing of countless textbooks pointing the way to salvation.



FEYNMAN

Most of this material has been prepared by those who have given primary attention to the teaching of physics and have not become too well known in fields of research. Their books, though often stamped to a

certain extent with the personalities of the authors, have tended to be conventional in general character, and understandably so, since books to be widely used must be published and publishers have a natural desire to stay in business. But from time to time physicists with outstanding research reputations have become sufficiently excited over the problems of elementary physics teaching to try to concoct something really new and unconventional in its approach. A good example is provided by *The Feynman Lectures on Physics*, volume 3 of which is the book under review.

These volumes are based on lectures given during the past few years in the introductory course in physics for freshmen and sophomores at the California Institute of Technology. The first two volumes have dealt primarily with mechanics, and electricity and magnetism respectively. The third is devoted to quantum mechanics. Some may question the appropriateness of presenting a treatment of the most advanced of physical theories and to this degree of sophistication to sophomores, even at an institution of the level of the California Institute of Technology. It is certainly an unconventional procedure! Its justification presumably lies in the fact that quantum mechanics is the most powerful tool for understanding modern physical experience, and the future physicist should get hold of it as soon as he reasonably can.

How well has the author succeeded in his treatment? With great skill he guides the neophyte from an introductory description of what quantum phe-

nomena are all about in terms of the wave-particle dualism on through the development of the concepts of state and probability amplitude with matrix analysis to the actual evaluation of the energy states of atomic systems. He uses a lot of words interspersed with clear diagrams of experiments, both mental and actual. He introduces frequent practical illustrations like the maser to sustain the students' interest. Throughout there is an air of breezy informality presumably designed to recapture the excitement of the lectures and the exuberance of the lecturer. To the mature physicist the development is indeed fascinating. Its impact on the elementary student is more questionable. Many will feel that the author is asking the student to think faster and more deeply than most are prepared to do at this stage of development. For most young people a grasp of fundamental physical ideas comes slowly, and though recipes can often be learned quickly, understanding of what they mean is a more gradual acquirement.

The reviewer has found some sections of particular interest, notably those on electron transmission through a crystal lattice and on the relation between the concept of symmetry and conservation laws. On the other hand he regrets that the author has seen fit to stress the probabilistic interpretation of quantum mechanics so emphatically as to give the impression that no change in this picture is ever possible. This gives the philosophy of the subject an unfortunate dogmatic twist, neither necessary nor desirable.

Without question this volume

Springer Tracts in Natural Philosophy

Edited by C. Truesdell, The Johns Hopkins University
Co-Editors: R. Aires, L. Collatz, G. Fichera, P. Germain, J. Keller, A. Seeger

**Volume 5 VISCOMETRIC FLOWS OF
NON-NEWTONIAN FLUIDS**

By B. Coleman, Senior Fellow, Mellon Institute, Pittsburgh
H. Markovitz, Senior Fellow, Mellon Institute, Pittsburgh
W. Noll, Professor of Mathematics, Carnegie Institute of Technology, Pittsburgh

After a brief introduction to concepts of modern continuum mechanics used in the general theory of simple fluids, this book gives a complete and self-contained presentation of the modern theory of steady viscometric flows, and explains, with critical comparisons, experimental techniques for realizing them in the laboratory. Three functions of the rate of shear are needed to characterize a simple fluid in viscometric flows; one gives shear stresses, the other two, normal-stress differences. The experimental determination of these functions is discussed with special emphasis on the principles of the measurements. Typical experimental results are presented.

Written in the spirit of contemporary rational mechanics, this book uses mathematics as a conceptual tool rather than merely as a device to express numerical relations. An appendix on mathematical concepts and notations will aid the reader with a limited background in modern mathematics. Also included are historical discussions showing the interaction between theory and experiment and a large, but selective bibliography.

Title #6733 37 figs. VIII, 129 pp. 1966 \$5.50

Volume 6 STUDIES IN NON-LINEAR STABILITY THEORY

By W. Eckhaus, Département de Mécanique, Université de Paris
As reviewed in "Applied Mechanics", May 1966 the journal
of The American Society of Mechanical Engineers.

"The book is concerned with some partial differential equations of hydrodynamics. At first, one dimensional equations of type $L(\phi) - \partial\phi/\partial t = F(\phi) +$ boundary conditions are treated, where L denotes a linear, F a nonlinear differential operator. Author splits up the solution $\phi = \phi_0(\eta) + \phi'(\eta, t)$ into a stationary term and a "perturbation" $\phi'(\eta, t)$.

The latter is expanded into a series $\sum A_n(t) \phi_n(\eta)$ of the eigenfunctions $\phi_n(\eta)$ of the linearized problem. The amplitudes $A_n(t)$ satisfy certain nonlinear differential equations of order one. Their stationary solutions govern, in a sense, the asymptotic behavior of the perturbation and, as a consequence, the stability. They are discussed in detail, the main tool being the introduction of suitable "small parameters" and the corresponding asymptotic expansions.

The results of the one dimensional theory are made use of in studying the considerably more intricate two dimensional problem.

Here, the coefficients of the eigenfunction expansion of the perturbation $\phi'(\xi, \eta, t)$ depend upon ξ and t . Author is particularly interested in perturbations which are periodic or at least "asymptotically" periodic with respect to ξ . It may happen that perturbations, initially aperiodic, tend to periodic ones.

In order to illustrate his methods, author considers some special cases which have been treated otherwise by different methods: Burger's model of turbulence and the flow between parallel walls (Poiseuille and Couette flow).

Though the main subject of the book belongs to fluid mechanics, it is of interest to people working in general stability theory because the methods developed by the author might be of use elsewhere and, on the other hand, the hydrodynamical problems might be accessible to the methods of general stability theory."

W. Hahn, Austria

Title #6734 12 figs. VIII, 117 pp. 1966 \$5.50

**Volume 7 THE GENERAL PROBLEM OF THE MOTION OF
COUPLED RIGID BODIES ABOUT A FIXED POINT**

By E. Leimanis, Professor of Mathematics, The University
of British Columbia, Vancouver, B.C., Canada

The Problems exhibited by the motion of the Earth's artificial satellites have stimulated further research of two classical unsolved dynamical problems: (i) the motion of a rigid body about a fixed point, and (ii) the motion of n -bodies ($n \geq 3$) subject to the Newtonian attraction. In addition, new problems have arisen. To name just a few: (i) separation of the general motion of mutually attracting rigid bodies into translations of their mass centers and rotations about the latter, (ii) rotation of an artificial satellite about its mass center, (iii) motion of a rigid body about a fixed point in a central Newtonian force field,

(iv) motion of a self-excited rigid body about a fixed point, (v) regulation of rotations by self-excitements, and so on.

The monograph attempts to account for the present state of the above problems and their development during the past two hundred years since the publication in 1765 of EULER's papers which contained his now classical equations of motion of a rigid body about a fixed point.

A reference work of interest to applied mathematicians and space scientists. Title #6735 66 figs. XVI, 337 pp. 1966 \$12.00



New Books for the Up-to-Date Researcher

Optics

OPTICAL INTERFEROMETRY

by M. Françon, *Institut D'Optique, Paris*

CONTENTS: Coherence Produced by Thermal Luminous Sources. Interferences of Two Waves by Wavefront Division. Interferences of Two Waves by Amplitude Division. Two-Beam Interferometers. Standing Waves. Multiple Beam Interferences. Polarization Interferometers. Interference and Partial Coherence. Intensity Interferometer. Interference with Lasers. Interferential Study of Wavefronts. Interferometric Measurement of the Transfer Function of an Optical Instrument—Noncoherent Illumination. Thin Films. Interference Spectroscopy. Application of Interferences for the Measurement of Length. Diverse Applications of Interference. Holography. *Subject Index.*

November 1966, about 350 pp., \$13.50.

Magnetism

MAGNETISM—A TREATISE OF MODERN THEORY AND MATERIALS

edited by George T. Rado, *U. S. Naval Research Laboratory, Washington, D. C.*
and Harry Suhl, *University of California, La Jolla*

VOLUME 2B: STATISTICAL MODELS, MAGNETIC SYMMETRY, HYPERFINE INTERACTIONS, AND METALS

CONTENTS: CONYERS HERRING, Direct Exchange between Well-Separated Areas. M. A. JENSEN and H. SUHL, Magnetism and Superconductivity. T. KASUYA, S-d and s-f Interaction and Rare Earth Metals. ANTHONY ARROT, Antiferromagnetism in Metals. *Author Index-Subject Index.*

December 1966, about 428 pp., \$16.00

Shock Waves

IN TWO VOLUMES . . .

PHYSICS OF SHOCK WAVES AND HIGH-TEMPERATURE HYDRODYNAMIC PHENOMENA

by Ya. B. Zel'dovich and Yu. p. Raizer, *Academy of Sciences, U.S.S.R.*

edited by Wallace D. Hayes and Ronald F. Probstein

This English version of the second Russian edition is a comprehensive presentation of high-temperature gasdynamics and gas physics, dealing with all the essential physical aspects and their influence on the dynamics and thermodynamics of continuous media.

VOLUME I (CHAPTERS I-VI)

December 1966, about 425 pp., \$18.00

SET PRICE: \$14.75*

VOLUME 2 (CHAPTERS VII-XII)

In preparation, \$18.00

SET PRICE: \$14.75*

*Set price applies to orders for both volumes. Billing for Volume 2 will not be made until delivery.

Thin Films

PHYSICS OF THIN FILMS, VOL. 3

ADVANCES IN RESEARCH AND DEVELOPMENT

edited by George Haas, *U.S. Army Electronics Command, Fort Belvoir, Virginia*

and Rudolf E. Thun, *International Business Machines Corporation, Owego, New York*

CONTENTS: KLAUS H. BEHRNDT, Film-Thickness and Deposition-Rate Monitoring Devices and Techniques for Producing Films of Uniform Thickness. LEON I. MAISSEL, The Deposition of Thin Films by Cathode Sputtering. L. V. GREGOR, Gas-Phase Deposition of Insulating Films. A. VECHT, Methods of Activating and Recrystallizing Thin Films of II-VI Compounds. R. W. HOFFMAN, The Mechanical Properties of Thin Condensed Films. D. E. BODE, Lead Salt Detectors. *Author Index-Subject Index.*

November 1966, 318 pp., \$14.00

THE USE OF THIN FILMS IN PHYSICAL INVESTIGATIONS

edited by J. C. Anderson

A NATO Advanced Study Institute

September 1966, 462 pp., \$18.00

WEAK INTERACTIONS AND HIGH-ENERGY NEUTRINO PHYSICS

edited by T. D. Lee, *Italian Physical Society, Course 32*

October 1966, 335 pp., \$16.00

STRONG INTERACTIONS

edited by L. W. Alvarez, *Italian Physical Society, Course 33*

October 1966, 226 pp., \$11.50

THE METHOD OF SECOND QUANTIZATION

by F. A. Berezin

November 1966, 229 pp., \$10.00

QUANTUM THEORY OF ATOMS, MOLECULES, AND THE SOLID STATE

by Per-Olov Löwdin

December 1966, 625 pp., \$25.00

MODERN DEVELOPMENTS IN THE MECHANICS OF CONTINUA

edited by Salomon Eskinazi

December 1966, about 200 pp., approx., \$7.50

ACADEMIC PRESS



NEW YORK AND LONDON
111 FIFTH AVENUE, NEW YORK, N. Y. 10003

should prove of enormous value as collateral reading for standard courses in quantum mechanics. Its status in elementary physics instruction is however open to question.

* * *

A frequent contributor of book reviews, R. Bruce Lindsay is Hazard Professor of Physics at Brown University.

At low temperatures

ELECTRICAL RESISTANCE OF METALS.
By George Terence Meaden. 218 pp.
Plenum Press, New York, 1965. \$11.50

by L. I. van Torne

The author states that this book was written to fulfill the needs of scientists and engineers who require a full and current presentation of the experimental facts together with a relatively concise account of the modern theory of the electrical resistance of metals and alloys. The author has achieved his goal, and students as well as scientists and engineers who need data or who measure electrical transport properties of metals should find this a valuable book.

In chapter 1 the author discusses the importance and utility of information concerning the electrical resistivity of metallic and semimetallic elements in the cryogenic temperature range. Chapter 2 is a comprehensive tabulation of electrical resistivity behavior of metallic elements at cryogenic temperatures. Chapter 3 gives a very brief outline of the theory of electrical resistivity in metals. A discussion of the Gruneisen-Bloch equation with regard to its limitations and utility for comparing resistivity data from different elements is given in chapter 4. Some remarks about the influence of alloying, plastic deformation, irradiation, high pressures, magnetic fields and specimen geometry on electrical resistivity are given in chapters 5 and 6. A review of electrical-resistivity measuring techniques at ambient temperatures and below and methods of achieving and controlling cryogenic temperatures are given in chapters 7 and 8. Rather complete author and subject indexes—often given in a cursory manner in books of this kind—allow the reader a

rapid means of finding a specific reference or item of interest.

In summary, this book contains a wealth of experimental data on electrical resistivity of metals at low temperatures and presents several methods of obtaining such data. However, in the author's words, "no pretense is made that any part of the theory is exhaustively covered."

* * *

The reviewer does electron microscopy and diffraction work in crystalline materials at the Martin Company, Orlando, Florida.

Fibrous and filamentary materials

CERAMIC AND GRAPHITE FIBERS AND WHISKERS: A SURVEY OF THE TECHNOLOGY. By L. R. McCreight, H. W. Rauch, W. H. Sutton. 395 pp. Academic Press, New York, 1965. \$10.00

by R. P. I. Adler

Taken as a bibliography and a current survey of the state-of-the-art of whisker and fiber technology this book can serve as a practical starting point for materials scientists wishing to enter this field. The most valuable portions of the volume are a cross-indexed selection of 550 references, over 200 patents, and 58 organizations concerned with the theoretical and practical aspects of fibrous materials. The topics that are covered are: The Potential Strength of Materials (chapter 2); Applications of Fibers (chapter 3); Factors Affecting Fiber Strength (chapter 4); Reports on Organizations Conducting Fibrous Materials Studies (chapter 5); Evaluation and Discussion (Chapter 6); Conclusions and Recommendations (chapter 7); Patents on Ceramic and Graphite Fibers (chapter 8); Bibliography (chapter 9).

The first technical chapter presents a very brief comparison between the actual and theoretical strengths of selected filamentary materials. The obvious parameters of temperature and elastic moduli that influence the theoretical strength are pointed out while some relatively low strengths are attributed to fabrication and testing conditions. This is followed by

semi-elements YOUR PRIME SOURCE FOR

SEMI-CONDUCTOR SINGLE CRYSTALS and MATERIALS

- II-VI Compounds
Cadmium Sulfide, Selenide, Telluride
Zinc Sulfide, Selenide, Telluride
Custom Compounds II-VIs
- III-V Compounds
Gallium Arsenide, Antimonide
Indium Phosphide, Arsenide, Antimonide
Custom Compounds of III-Vs

SINGLE CRYSTAL FERRITES

- YIG
YTTRIUM IRON GARNETS
- YGIG
YTTRIUM GALLIUM IRON GARNETS
- EIG
ERBIUM IRON GARNETS
- NIF
NICKEL IRON FERRITES
- MIF
MANGANESE IRON FERRITE
- LiN
LITHIUM NIOBATE
- BaT
BARIUM TITANATE

Literature sent promptly on request



semi-elements, inc.
Saxonburg Blvd., Saxonburg, Pa., 16056
Phone: 412-352-1548