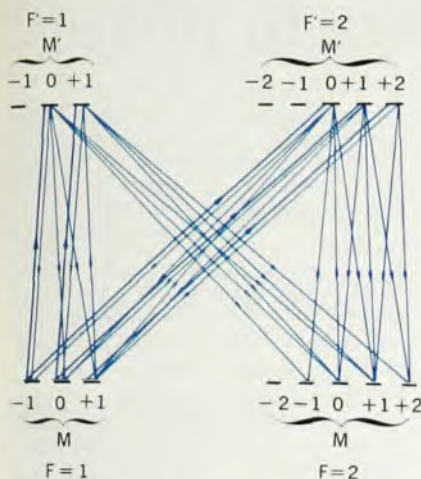




TYPICAL OPTICAL transitions are shown in the optical pumping cycle of an atom having a $^2S_{1/2}$ ground state, a $^2P_{3/2}$ resonant excited state and a nuclear spin $I = 3/2$.

the section of interest and obtain a current summary of that field. Graduate students should find it useful in surveying the current problems in atomic and electron physics.

The book begins with a chapter on optical pumping, in which not only the experimental, but also the theoretical foundations are discussed. The next section on electron swarms presents information on electron-atom interactions and also includes afterglow experiments. The discussion on shock tubes is primarily a rather complete description of production techniques of high-temperature shock waves in gases.

Chemical-reaction rate measurements at high temperature are included in the flame-kinetic studies, a section that has a particularly extensive bibliography. In dealing with the interaction of heavy particles with solids, the authors present, among other things, an interesting discussion of the "channeling" effect in crystals, where the incident particle moves between the layers of atoms forming the lattice. The book closes with a chapter on electric arcs, their production and application to the study of atomic processes.

In general this book should be useful to anyone working or thinking of working in atomic-collision physics. It is well written and provides a clear and concise review of current work.

* * *

Gilbert O. Brink is an associate professor of physics at the State University of New

York at Buffalo and has been active in experimental research in atomic physics for 12 years.

Storage tubes

ELECTRONIC IMAGE STORAGE.
B. Kazan and M. Knoll, ed. 498
pp. Academic, New York, 1968.
\$19.50

by LADISLAUS MARTON

B. Kazan and M. Knoll's book is an outgrowth of two of their own earlier publications. In 1952 they published a relatively short book titled *Storage Tubes and Their Basic Principles*. This was followed four years later by a critical review entitled "Viewing Storage Tubes," published in *Advances in Electronics and Electron Physics*.

Electron Image Storage, an entirely up-to-date and expanded version of the earlier book, begins with a thorough discussion of basic processes, such as secondary emission, photo emission, photoconductivity, electron bombardment, induced conductivity and luminescence phenomena. This section is followed by the description of writing and reading processes in charge-storage devices, by the discussion of signal-converter devices (which exist in a remarkable variety) and display devices, such as cathode-ray tubes, electrostatic film-deformation displays, xerographic displays, birefringent, crystal displays and many others.

The last two important chapters deal with camera-pickup devices and image-converter devices which, although not strictly storage devices, are sufficiently related to be included. A rather useful appendix at the end contains "Storage Tube Definitions" taken from the 1962 Institute of Radio Engineers Standards on Electron Tubes.

Although I have concentrated on the vacuum-device aspects, on which the authors are very well known authorities, the book contains an added short chapter on magnetic-storage devices. It is so condensed that it serves only to whet the reader's appetite for looking at the (fortunately sufficient) references. With the extremely widespread applications of storage and similar devices (television, telemetering, computers, teaching, decision making, and many others), it became quite timely to reissue an im-

proved version of the authors' older book. The new version will, no doubt, be very well received by the scientific and technological community.

* * *

The reviewer is with the office of international relations at the National Bureau of Standards.

Carbon and its modifications

CHEMISTRY AND PHYSICS OF CARBON: A SERIES OF ADVANCES, VOL. 4. Philip L. Walker, Jr. ed. 399 pp. Marcel Dekker, New York, 1968. \$20.75

by MARTIN E. STRAUMANIS

This volume is the fourth in a series, edited by Philip Walker Jr, professor and head of the materials science department at Pennsylvania State University, and consists of six articles written by 11 authors, all of them experts in carbon research.

The first four chapters are of interest for the physicist. Considering the great importance of carbon and its modifications in nature, in industry and in research, there is no wonder that many crucial experiments and measurements were performed with carbon, graphite and diamond. It follows from the first article, written by W. Ruland, that the allotropy of carbon gave an impulse to one of the first structural studies with x rays. Accordingly the theory of scattering of x rays by carbon and graphite is in the first article, with mathematical descriptions of two-dimensional lattices, of small-angle scattering, order and disorder phenomena, lattice imperfections and preferred orientation.

Rates of carbon vaporization, heats of sublimation, composition of vapor, melting of graphite and similar problems are discussed in the next article by H. B. Palmer and Mordecai Shelef.

In the following chapter, S. B. Austerman discusses the crystallization of graphite from solutions in molten metals (iron, nickel, molybdenum, chromium). Iron can be evaporated from a solution of carbon in iron at 3000°C, and graphite crystals grow from the melt. There is also a possibility of controlling the amount of defects in such crystals. The article by T. Tsuzuku and M. H. Saito shows how internal friction measurements can determine the dislocation movement in

new north-holland publications in physics

Nuclear and Particle Physics

THE OBSERVATION OF ATOMIC COLLISIONS IN CRYSTALLINE SOLIDS

By **R. S. Nelson**, Atomic Energy Research Establishment, Harwell, U.K.

Describes the more important experiments which have led to a better understanding of atomic collision phenomena in solids. Emphasis is on the part played by the regular nature of the crystalline lattice in the correlation of successive collisions. The first half of the book deals with the interaction of the incident bombarding particles with the solid, i.e. their trajectories and penetration depths, while the second half is concerned with the resulting collisions which occur as a consequence of atomic recoil.

1968 291 pages \$16.50

THERMODYNAMICS

An advanced course with problems and solutions

By **R. Kubo**, University of Tokyo (in co-operation with H. Ichimura, T. Usui and N. Hashitsume).

Contains a series of lectures on fundamental theories of thermodynamics, together with carefully chosen examples and a number of problems with their solutions. Emphasis is placed on the phenomenological aspects of the subject, and all basic principles are covered in such a way as to facilitate reference.

1968 300 pages \$16.00

LOW-ENERGY NEUTRON PHYSICS

By **I. I. Gurevich** and **L. V. Tarasov**, U.S.S.R. Academy of Sciences, Moscow.

Provides a physical and rigorous account of the nature and properties of the interaction between low-energy neutrons and various media and reviews the different applications of such neutrons in physical studies. Emphasis is on nuclear scattering as compared with magnetic scattering of slow neutrons.

1968 607 pages \$28.00

NUCLEAR REACTION ANALYSIS: graphs and tables

By **J. B. Marion** and **F. C. Young**, University of Maryland.

In the planning and interpretation of nuclear reaction experiments it is almost always necessary to refer to auxiliary graphs and tables of various types. In general these are scattered throughout the published and unpublished literature. In this book the more useful graphic and tabular material is assembled in a way that provides a convenient collection for experimental nuclear reaction physicists.

1968 169 pages \$12.00

HYPERFINE STRUCTURE AND NUCLEAR RADIATIONS

Proceedings of the International Conference on Hyperfine Interactions Detected by Nuclear Radiation, Asilomar, Pacific Grove, Cal. August, 1967.

Edited by **E. Matthias**, Lawrence Radia-

tion Laboratory, Berkeley, Cal. and **D. A. Shirley**, University of California, Berkeley, Cal.

The theme of the conference was the interactions between nuclei and their environments, as studied by nuclear radiation (e.g. nuclear orientation, perturbed angular correlations, Mössbauer spectroscopy, etc.) and the use of these interactions to elucidate solid-state and nuclear structure.

1968 1097 pages \$25.00

Dispersion Relations Dynamics

THE INTERACTIONS OF HADRONS

By **H. Pilkuhn**, Department of Theoretical Physics, University of Lund, Sweden.

A textbook on strong and weak interactions, which also includes electromagnetic interactions, with the exception of radiative corrections. An important part of the book is dedicated to phenomenological analysis. Models and theoretical speculations are presented and many experimental results are included.

1967 375 pages \$16.00

WINDS AND TURBULENCE in stratosphere, mesosphere and ionosphere

Proceedings of the NATO Advanced Study Institute, Lindau, Germany, Sept.-Oct. 1966.

Edited by **K. Rawer**, Ionosphären-Institut, Breisach, Germany.

The theme of the conference was the relationship between mesospheric and lower ionospheric phenomena and the participants were drawn from two main fields of research: meteorologists studying the upper atmosphere and scientists working on radio propagation and ionospheric investigations.

1968 421 pages \$18.50

SPIN WAVES

By **A. I. Akhiezer**, **V. G. Bar'yakhtar** and **S. V. Peletminskii**, Academy of Sciences of the Ukrainian S.S.R., Kharkov.

Covers one class of properties resulting from the Heisenberg model of ferro and antiferromagnetic systems, namely the excitations near the ground state—spin waves. The book is of particular interest as the development of the concept of elementary excitations in many body systems owes a great deal to the work of Russian theoreticians and this translation enables Western readers to follow a systematic presentation of this development as applied to magnetism.

1968 369 pages \$21.50

FUNDAMENTAL PROBLEMS IN STATISTICAL MECHANICS II

Proceedings of the Second NUFFIC International Summer Course, Noordwijik, The Netherlands, June-July 1967.

Edited by **E. G. D. Cohen**, Rockefeller University, New York.

The lectures critically survey a number of problems in statistical mechanics. The authors are all active scientists in their respective fields and have in many cases made major contributions to the

new developments of the last five years. Emphasis is in general placed more on clarity of presentation and an understanding of the problems as a whole than on specialized methods.

1968 338 pages \$11.00

MOLECULAR FORCES

Proceedings of the Study Week organized by the Pontifical Academy of Sciences, April, 1966.

Contains 22 papers presented by scientists of international stature, and the discussions that followed their delivery. Subjects covered were the theory of molecular forces and some methods of obtaining information on them, and molecular forces in relation to the study of colloids, liquids, surfaces and biological systems.

1967 754 pages \$24.00

In Preparation

EXCITATION MECHANISMS OF THE NUCLEUS

Nuclear Theory Volume 2

By **J. M. Eisenberg**, University of Virginia, Charlottesville, and **W. Greiner**, University of Frankfurt, Germany.

Deals with electromagnetic and weak interactions in nuclei and their usefulness for obtaining information on nuclear structure. The subject matter is presented in detail and is very closely reasoned so that the book is particularly suitable for use as a text in graduate-level nuclear physics courses as well as being of value to research workers in this area.

1969 385 pages In press

PROGRESS IN LOW TEMPERATURE PHYSICS Vol. 6

Edited by **C. J. Gorter**, University of Leyden, The Netherlands.

The sixth volume in this famous series contains 10 chapters by physicists from the U.S.A., U.S.S.R. and Western Europe. Topics covered include: experimental properties of pure and dilute solutions of He^3 in superfluid He^4 at very low temperatures; superconductivity in semiconductors and semi-metals; diffusion and relaxation of nuclear spins in crystals containing paramagnetic impurities; superconductivity above the transition temperature; superconducting point contacts weakly connecting two superconductors; pressure effects in superconductors; intrinsic critical velocities in superfluid helium; critical behaviour in magnetic crystals; the international practical temperature scale of 1968; and third sound.

1969 Approx. 430 pages \$23.00



obtainable from
Wiley-Interscience
a division of
John Wiley & Sons, Inc.
605 Third Avenue
New York, N.Y. 10016

the basal plane of graphite crystals.

The book is interesting and revealing, and the articles, supplied with many illustrations (some of them excellent), are well written.

* * *

The reviewer is professor in the metallurgical engineering department and is working at the Materials Research Center of the University of Missouri-Rolla in crystallization of x rays.

Gamma-ray resonance

LECTURES ON THE MÖSSBAUER EFFECT. By J. Danon. 150 pp. Gordon and Breach, New York, 1968. Cloth \$7.50, paper \$4.50

by GUNTHER K. WERTHEIM

This volume is based on notes taken by E. de Alba, X. da Silva and M. A. Weber at a series of lectures given at the Latin American School of Physics at the University of Mexico during July and August, 1965. They were first published in *Many-Body Problems and Other Selected Topics in Theoretical Physics* edited by Marcos Moshinsky, Thomas Brody, and G. Jacobs, also issued by Gordon and Breach some years ago. The present version has been slightly augmented, mainly by the addition of reprints and an occasional appendix. The references, however, do not include work later than 1965.

Jacques Danon has been active in Mössbauer-effect research since its early days. In this book he covers the same ground, using a similar approach, as do a number of other introductory monographs of comparable length. However, his treatment is unique in presenting in detail the author's treatment of the isomer shift utilizing a molecular-orbital approach.

Another useful feature is a major section dealing with the theory of the recoil-free fraction. It was contributed by Yehiel Disatnik and provides more detailed information than is available in other monographs.

The spirit implied by "lectures" has been retained to a large extent. Figures showing data from the literature have been redrawn, omitting data points and providing only an approximate rendering of their essential character. Axes are incompletely labeled. It is unfortunate that there is no mention of other useful compendia.

The chief value of the book lies in

the areas mentioned above where it makes a unique contribution. The material chosen for reproduction in the appendix provides a good indication of its strong points.

* * *

The reviewer, a member of the technical staff at Bell Telephone Laboratories, is the author of a number of papers dealing with the Mossbauer effect.

Experimental determination

OPTICAL PROPERTIES AND BAND STRUCTURES OF SEMICONDUCTORS. By David L. Greenaway and Gunther Harbeke. 159 pp. Pergamon, New York, 1968. \$9.00

by HAROLD MENDLOWITZ

The authors have put together a fairly broad review of optical properties and band structure of semiconductors through 1966. Although the emphasis is on experimental determination, a number of theoretical concepts and results are briefly treated in order to understand and "catalog" the experimental results.

The optical region covered is from the infrared to the vacuum ultraviolet. Band structures of cubic as well as anisotropic materials are discussed. Experimental methods for determining the band structure include optical absorption and reflectivity measurements, as well as the interpretation of deformation phenomena, excitons, electro-optical phenomena, photoemission and characteristic electron energy-loss experiments in solids.

The major emphasis is on classical methods, that is absorption and reflectivity measurements, with less than a page devoted to electron energy-loss experiments. Although this latter method is important for obtaining information on the optical constants in the vacuum ultraviolet, the authors apparently had access only to the first paper on this subject, an application to the optical constants of aluminum that appeared in 1962. They recognize its applicability to nonmetals, but were unaware of subsequent papers utilizing this method that appeared in 1964 on polystyrene, an insulator, in 1965 on beryllium, and in 1967 on germanium, a semiconductor. Of course, each author's point of view determines which methods to emphasize, and the classical methods are still the ones that yield the bulk of the data

utilized in determining the band structure. However, the omission of the 1967 paper on germanium is probably because the literature search was closed prior to publication.

Overall, the authors did accomplish their goal of making a substantial contribution by making a fairly complete review.

* * *

The reviewer is a professor at Howard University and has been doing research on the optical properties of solids for the past decade.

Cosmological approaches

THEORIEN DER KOSMOLOGIE. (In German) By Otto Heckmann. 113 pp. Springer-Verlag, New York, 1968. \$6.00

by ERNST J. OPIK

This is an exact reprint of a first edition published in 1942, which sold out immediately after its appearance. Only a few corrections are now made, and three pages of notes superficially refer to modern developments.

The reprint has been produced under the pressure of demand, but the author, formerly director of Hamburg Observatory and now director of the European Southern Observatory, did not find time for a revision. Besides, a revision would mean rewriting most of the book in view of the enormous progress in observational research during a quarter of a century, including observations of radio sources, quasars and pulsars. Even Heckmann's more recent contribution, pointing out the possibility of an inbuilt angular momentum in preventing collapse of the universe, is not included.

Despite the outdated factual material, its permanent value consists of a systematic presentation of the three different approaches to cosmology: the classical or dynamical presentation, based on plain Newtonian mechanics; the Einsteinian general relativity, and Milne's kinematic cosmology. Contrary to widespread opinion, persisting even now, there is much common ground between the first two models. Finesses of general relativity, such as the advance of Mercury's perihelion, are not essential on the cosmological scale. Therefore, Newton's dynamical and Einstein's metrical methods lead to practically identical conclusions.

When first published Heckmann's