fluences on the structure of the diffracted rays. The mathematical methods are simple but fundamental and suffice to examine all the basic problems without obscuring them. The chapter on small-angle scattering brings together the rather diffuse literature on the subject, much of it by the author himself.

Those who wish to study the mechanics of diffraction and what one can learn from it about crystal imperfections would do well to study this book carefully. Disorder and imperfection problems are of great actual interest and form the subject of extensive investigations. This lucid exposé of the various experimental methods, and of what one can learn from them, is likely to prove extremely helpful to workers in the field.

Fundamentals of Ultrasonics. By J. Blitz. 214 pp. Butterworths, London, 1963. $6.95.
Reviewed by Walter G. Mayer, Michigan State University.

The small family of introductory texts on ultrasonics has been increased by one. Although this new book is relatively small, it is very informative and should be brought to the attention of the student of physical acoustics who is asking for a modern, uncomplicated, and not particularly specialized book on ultrasonics.

The author divides the book into essentially two over-all groups of chapters: low amplitude and high energy waves. The first of the chapters on low amplitude waves deals with general principles of propagation, velocity, impedance, absorption, reflection, and diffraction. The section on propagation in gases describes classical concepts of velocity and absorption; it also includes a discussion of relaxation and velocity dispersion. The chapter on low amplitude waves in liquids treats current topics like propagation in liquid helium, shear and hypersonic waves in liquids, in addition to more fundamental topics. The section on solids gives enough classical background, so the reader can follow the more modern topics of absorption due to lattice imperfections, electron-phonon interactions, and photosensitive attenuation. These chapters also give condensed descriptions of experimental techniques and methods of measurement. The last chapter in this group describes briefly low power applications: flaw detection, delay lines, and other applications.

The chapter on high energy waves contains short discussions on cavitation, cleaning, and some other effects. The much longer section (Chapter 3) on generators and receivers gives an introduction to transducer theory, and applications of many types of transducers, including the depletion layer transducer.

One should not expect a complete and detailed treatment of all of these subjects, and in some instances the discussion is rather sketchy. This does not seem to be too serious, because the author frequently refers the reader to standard books (Kinsler and Frey, Cady, Mason, Bergmann's collection, etc.) whenever he feels that these books already cover a particular topic. However, in doing so the author has not sacrificed continuity and balance of his own text.

The book is up to date and deals with topics one does not usually find in elementary texts. I believe that students and teachers of ultrasonics will find this book helpful.

Operator Techniques in Atomic Spectroscopy. By Brian R. Judd. 242 pp. McGraw-Hill, New York, 1963. $9.95.
Reviewed by J. A. White, National Bureau of Standards.

When applied to electronic configurations as complex as those commonly found in rare-earth and transition-metal ions and salts, the familiar, straightforward, and elementary techniques for compounding the angular momenta of equivalent particles often prove discouragingly cumbersome. Many potent methods have been developed to handle such complex configurations, however, and these are expounded with unusual clarity and scope, though not always in great detail, in Professor Judd's *Operator Techniques*. The methods necessarily lean heavily on abstract mathematical properties of finite and continuous groups. Professor Judd has attempted throughout, however, to keep the practical researcher in mind, and has included for this purpose a good and abundant collection of illustrations and exercises (some touching on controversies still current in the literature). He has taken pains with details and has used a consistent and familiar notation.

A list of some of the figures in the text will suggest the range of mathematical topics treated. There are coupling diagrams for 3,6,9, and 12-j symbols, root figures and arrays of weights for continuous groups, and Young tableaux for equivalent electrons. These and interesting asides—to note, for example, which of all simple groups obtained in Cartan's complete classification in 1894 have yet to find application in spectroscopy (answer: surprisingly few—compare p. 112)—lighten the mathematics. Even with the illustrations, the diverting asides, and concise paragraphing, however, the central portion of the book, dealing at length with abstract group properties, may seem unnecessarily demanding and extensive to many workers in the field. Fortunately, much of this material can be left to be savored at leisure as a rich dessert, for the preceding and following sections can be used independently for most practical calculations. Only the simpler group properties are used in the early chapters to dispose efficiently of simple configurations and general effects of external fields, while in the later chapters the reader is instructed in the use of Racah's tables of coefficients to calculate matrix elements in complex configurations.

The practicality of the techniques is nicely illustrated in the last chapter in a detailed discussion of the configuration f^6 such as is found in the Pu ion in PuI. There, the energy levels for the free ion, their decompositions and displacements in crystal fields, and the nature of the superposed hyperfine structure are treated and compared with experiment.

Although ambitious in scope, this is not a long book—only 242 pages. When used either as a text for a graduate course or as a research tool, therefore, it will need to be supplemented with other material to complete the discussion of many subjects. The carefully selected, representative bibliography should be helpful for this purpose, while serving also as an introduction to research problems. To sum up: in this reviewer's opinion, Pro-

Texts and Reference Books for the Physicist

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The Nobel Lectures in Physics are offered for the first time in English, from 1901 through 1962. Each lecture is preceded by the presentation address to the Laureate and is followed by his biography. Volume 3, 1942-1962, available in May. Vol. 2, 1922-1941, Sept.; Vol. 1, 1901-1921, Early 1965. Available by subscription to three-volume series only. $85.00

INTRODUCTION TO THE VIGIER THEORY OF ELEMENTARY PARTICLES

Louis DeBroglie. A system for classification of recently discovered elementary particles. Quantum numbers are defined which characterize each type of elementary particle. *1963* $11.00

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Y. A. Schrieder; translated from the Russian. A clear discussion of the basic principles of the Monte Carlo method and its use in mathematics and statistics. *April* $15.00

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R. E. Bellman, R. E. Kalaba, M. C. Prestrud and H. Kagiwada. This RAND Corp. research study is second in a series and presents latest analytical techniques developed at RAND. *April* $7.50

INVARIANT IMBEDDING AND RADIATIVE TRANSFER IN SLABS OF FINITE THICKNESS

R. E. Bellman, R. E. Kalaba, and M. C. Prestrud. First volume in the series: New Analytical and Computational Techniques in Mathematics, Physics and Engineering. The techniques described have as their objective solution using a digital computer. *1963* $6.50

INTRODUCTION TO RANDOM VIBRATION

J. D. Robson. This book discusses available concepts and techniques of random vibration including many not previously codified and organized for engineering use. *April* $6.75

INTRODUCTION TO AUTOMATIC CONTROL

Keisuke Izawa. This standard Japanese treatise on feedback controls presents fundamental control theory as well as servo-mechanisms and process control. *1963* $15.00

DICTIONARY OF GENERAL PHYSICS—in English, Dutch, French, German, Italian and Spanish

W. E. Clason. Compiled and arranged on an English base; contains 3,409 entries with definitions. *1962* $22.50

DICTIONARY OF AUTOMATIC CONTROL—in English, French, German and Russian

W. E. Clason. Contains 2,598 entries with cross-keyed alphabetical indexes for each of the four languages included. *1963* $12.50

DICTIONARY OF PURE AND APPLIED PHYSICS (Vol. 1, German to English; Vol. 2, E-G)

L. DeVries and W. E. Clason. 31,000 Terms cover pure physics and all branches of applied physics. Vol. 1, German to English, Dec. 1963, $9.95. Vol. 2, English to German. *April* *$9.95*

SUPPLEMENT TO DICTIONARIES OF ELECTRONICS, NUCLEONICS AND TELECOMMUNICATION

W. E. Clason. Supplement in six languages (Engl., Fr., Sp., It., Du., Ger.) to six multilingual dictionaries issued 1956 and following. *1963* $18.00

TECHNICAL ASPECTS OF SOUND (3 Volumes)

E. G. Richardson, editor. The basic theory of acoustics, together with all applications of sound and ultrasonics. Volume 1, Sonic Range and Airborne Sound, *1953*, $14.00; Vol. 2, Ultrasonic Range, Underwater Acoustics and Aircraft Noise, *1957*, $14.00; Vol. 3, Recent Developments in Acoustics. *1962*, $14.00.

ORGANIC SCINTILLATION DETECTORS

Eric Schramm. Deals with the properties of scintillators, the fundamentals of auxiliary equipment, description and applicability of techniques and devices, uses and applications. *1962* $7.50

APPLIED MECHANICS: Proceedings of 10th Int'l Congress, Stresa, Italy, 1960

F. Rolla and W. T. Koiter, editors. Complete text of lectures by outstanding scientists, and summaries of 188 papers under 2 headings: Fluid Dynamics, and Mechanics of Solids. *1962* $18.00

fessor Judd's book offers a welcome balance of careful mathematics and suggestions for practical applications; it should serve for several years as a useful nucleus of an introduction to the interpretation of the experimentally accessible and frequently, clearly delineated spectra of lanthanides and actinides in ionic crystals.

Encyclopedia of Physics, Volume VIII/2, Fluid Dynamics II. S. Flügge and C. Truesdell, eds. 696 pp. Springer-Verlag, Berlin, 1963. DM 198.
Reviewed by Jacques Romain, Centre de Recherches Routières, Brussels, Belgium.

As would be expected in this collection, the volume under review is made of careful review articles by experts in their respective fields. This is the second volume devoted to fluid dynamics. In view of the quality of the contributions and of the presentation, it is well worthy of Flügge's *Handbuch*.

The first half of the book consists of a thorough and extensive review by R. Berker (in French) of the integration of the equations of motion of an incompressible viscous fluid. The author gives a systematic presentation and analysis of the exact and approximate solutions of the Navier-Stokes equations and of the simplified Stokes or Oseen equations, which are dispersed in the literature. This work is more oriented toward applications than Ladyzhenskaya's book recently reviewed in this journal.

A shorter German paper by J. Weissinger synthesizes the essentials of wing theory in the case of stationary motion in a frictionless incompressible medium.

The remainder of the book is written in English. Two papers deal with turbulent flow. One, by C. C. Lin and W. H. Reid, is a mathematical exposition of the statistical theory of turbulent flow, with the emphasis on the basic concepts and relations and on the so-called homogeneous turbulence. The second turbulent flow paper, by S. Corrsin, is concerned with a description of experimental methods and their limitations, including the generation of some "classical" turbulent flows; experimental details are omitted.

S. A. Schaaf deals with the mechanics of rarefied gases (low density, perfect gas effects) with the emphasis on problems of aerodynamic interest.

Finally, A. E. Scheidegger writes a paper (largely based on his recent book) on hydrodynamics in porous media, another field in which pieces of information are widely scattered. The article presents the general features of flow and hydrostatics in porous media and discusses the theories produced to fit the experimental facts and their limitations.

The bibliographical references are abundant. Most of the articles appear to be up to date as of 1960, which is the probable actual date of completion of the manuscripts. The reviewer has not been able to determine the motivation of the editors in providing a bilingual English-German subject index for the English and German contributions, and a separate French index for the first article.

Advanced Computer Programming. A Case Study of a Classroom Assembly Program. By F. J. Corbató, J. W. Poduska, J. H. Saltzer. 170 pp. M. I. T. Press, Cambridge, Mass., 1963. $5.00.
Reviewed by William Siler, Memorial Hospital.

The remarkable infiltration of computers into the universities and laboratories has brought about an increasingly sophisticated attitude towards them on the part of scientists. Now that these electronic beasts are readily available, the problem of communicating with them is now almost as well known as the problem of communicating with Martians. Familiarity with the algebraic compiler languages such as Fortran, Algol, and Mad has become sufficiently widespread so that the deficiencies of these languages as well as their power are becoming known to more than a few. In consequence, development of new languages has become almost a parlor sport among the cognoscenti. For those cases in which existing languages are unsatisfactory and the development of a new language to solve a particular class of problems must be seriously considered, a working knowledge is needed of the inner mechanisms of compilers and assembly routines, the translators which convert a problem-oriented source language into the machine language of the computer itself. For those who expect to become involved in the creation or modification of a computer language, *Advanced Computer Programming: A Case Study of a Classroom Assembly Program* will serve as a more than adequate introduction. The official title, "Advanced Computer Programming", is a bit misleading; the reader who expects to find a general text on an advanced level will indeed be disappointed. The subtitle, "A Case Study of A Classroom Assembly Program", is highly accurate. The book contains 45 pages of text in which are explained in tightly written but comprehensible form the main features of an assembly program developed for use in formal courses at MIT using the IBM 7090 computer. For the teacher who wishes to use the book as a text, Appendix A gives in 120 pages a complete listing in FAP and machine language of the complete assembly program, an assembly output and a sample CAP language program, as well as a number of FAP assembly listings of "Programs to Allow Use of CAP in the Laboratory". Finally, there is an appendix with a number of suggested modifications to CAP for use as student problems.

The material is tied somewhat too closely to the particular system described, and an additional ten pages or so of text orienting the reader would have been valuable. Nevertheless, the reader seriously interested in compilers but with little or no experience will find the book very helpful. All others beware!

The Solar Corona. John W. Evans, ed. Internat'l Astronomical Union Symp. Proc. (Cloudcroft, N.M., Aug. 1961). 344 pp. Academic, New York, 1963. $14.00.
Reviewed by E. J. Öpik, Armagh Observatory and University of Maryland.

The corona accounts for only 10^{-15} of the sun's mass; yet, being the sun's external frontier, it controls corpuscular, short-wave ultraviolet, and x-ray radiations which permeate interplanetary space and play a decisive part in the physics of planetary ionospheres and in the phenomena of comet tails. The interplanetary gas is but an extension of the corona, blown away steadily or in gusts of the "solar