

subsequent research by the author himself as well as by others.

The presentation of Galois field theory in the first part of the book stands to this day as a model of lucid exposition; and very little would have to be added to bring it completely up to date. The second part of the book is taken up with an exposition of linear groups. Although Chevalley and others have since, indeed very recently, added considerably to our stock of such groups, it is interesting to note how nearly all the basic ideas are to be found in this work of nearly sixty years ago. And the abundance of skillfully selected exercises and worked examples can be a boon to student and teacher alike.

The publication of the book at a very moderate price will be welcomed by all who are interested in Galois theory.

On Numerical Approximation: Proc. of US Army Math. Research Center Symp. (U. of Wisc., Apr. 1958). Edited by Rudolph E. Langer. 462 pp. The U. of Wisconsin Press, Madison, Wisc., 1959. \$4.50. *Reviewed by George Weiss, Institute for Fluid Dynamics and Applied Mathematics, University of Maryland.*

IN the very short time since the development of the digital computer, the subject of numerical analysis has become one of current and compelling interest. Although a knowledge of numerical analysis is not yet a required part of a physicist's education, there is no doubt that it is now of enough importance to attain that status. The fact that digital computation methods are of primary importance in the fields of reactor design, other neutron diffusion problems, and celestial mechanics should considerably stimulate the interests of physicists in the relatively unfamiliar methods of numerical approximation. The present volume contains a collection of papers on that subject, most of which are in the nature of review articles on current research.

As in most collections of review articles there is wide scatter in the level of sophistication required for the reading of the individual papers. Fortunately none of the papers in this volume have completely wandered off into abstract spaces, and most are intelligible to the physicist with a good background in general analysis and at least a passing acquaintance with the concepts of functional analysis.

The introductory article by Ostrowski, "On Trends and Problems in Numerical Approximation", is a well-written account of some challenging problems in the field. A long article by Golomb and Weinberger deals with the systematic development of error bounds for numerical approximations. Using quite elementary techniques in functional analysis these authors develop error estimates which are practical as well as elegant for numerical methods in boundary value problems, interpolation problems, quadrature problems, and other linear approximation procedures. A paper by Hammer serves to point out the present difficulties in the numerical evaluation of multiple integrals because of the

inability to find a proper analogue to Gaussian integration in higher dimensions than one. The contribution by Davis presents results relating to the superiority of trapezoidal integration rules over Gaussian quadrature, when dealing with certain periodic functions. There are many other papers in this volume, all of more or less specialized mathematical interest, on asymptotic expansions, extremal polynomial approximations, interpolation procedures, and applications of the concepts of linear spaces to the problems of numerical approximation. It is probable that among them the nonnumerical analyst will find at least some of interest.

Atoms III—Molecules I. Vol. 37, Part 1 of *Handbuch der Physik*. Edited by S. Flügge. 439 pp. Springer-Verlag, Berlin, Germany, 1959. DM 120.00 (subscription price DM 96.00). *Reviewed by Stuart A. Rice, Institute for the Study of Metals, The University of Chicago.*

VOLUME 37 of the *Handbuch der Physik* contains but three articles, all in English. These deal respectively with atomic and molecular beam spectroscopy, vibration-rotation spectra of molecules, and collisions of electrons with molecules.

Molecular and atomic beam studies have provided the experimental basis for much of modern physics. Stern's early experiments demonstrating space quantization, the determination of the anomalous spin magnetic moment of the electron by Kusch, the measurement of molecular dipole moments as a function of vibrational state by electric resonance, etc., indicate the range and power of this general experimental technique.

The first article, by Kusch and Hughes, is a magnificent summary of the methodology of, general theory of, and experimental results obtained from molecular beam studies of atomic and molecular structure. The article is of necessity shorter than Ramsey's book, but nevertheless manages not to slight any of the three general subtopics mentioned. An excellent bibliography, ordered both by year and alphabetically, makes the article extraordinarily valuable in tracking down the literature. Approximately 150 references dating from 1955 may be considered to supplement those in Ramsey's text.

The article entitled "Vibration-Rotation Energies of Molecules and their Spectra in the Infra-red" by Nielsen is an excellent account with emphasis on the theoretical details of higher order analysis than the elemental harmonic oscillator-rigid rotor approximation. In view of the material and the volume for which the article was written, the subsection on the general formulation of quantum mechanics appears somewhat out of place.

Finally, while due credit has been given to the experimental technique of molecular beams in establishing some of the basic concepts of quantum theory, the Franck-Hertz experiment demonstrating discrete atomic states must not go unmentioned. The Franck-Hertz experiment was one of the earliest quantitative studies

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of the collisions of electrons with molecules, which is the subject of the last article by Craggs and Massey. The article is an excellent survey of both theory and experimental results. Of particular interest is the extensive discussion of experimental data for ionization of polyatomic molecules.

This volume will be a welcome addition to the reference shelves of all investigators primarily concerned with molecular structure. It will be of especial use to the physical chemist, uninformed of the power and potential usefulness of the techniques exposed in the first and third articles.

Power Unlimited! The Story of Power—from Windmill to Nuclear Energy. By Abraham and Rebecca B. Marcus. 152 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1959. \$3.50. *Reviewed by Peter L. Balise, University of Washington.*

SINCE a basis of modern civilization is the use of energy from sources other than men and animals, a well-written book on power should be of interest to many laymen. Such a book is *Power Unlimited*. Although the jacket describes it as "entertaining", this reviewer would classify the book as a clear explanation for the layman interested in a little serious reading; rather than describing dramatic examples of power, the authors have emphasized understanding the basic operation of energy-conversion devices.

The coverage is quite complete, beginning with diagrams showing why a windmill turns and concluding with lucid explanations of the present state of fusion and solar power research. Little if any prior knowledge is assumed; for example, the rather thorough discussion of electric motors is preceded by an explanation of a graph in terms of a hospital patient's temperature chart.

The book is recommended for high-school students or others who would like to understand "how things work".

Fourier Transforms and X-Ray Diffraction. By H. Lipson and C. A. Taylor. 76 pp. (G. Bell & Sons Ltd., England) The Macmillan Co., New York, 1958. \$4.50. *Reviewed by I. Fankuchen, Polytechnic Institute of Brooklyn.*

FOURIER transforms were proposed about twenty years ago for use in crystal structure determination but their use has never really become widespread. The senior author of this book has probably done more than anyone else to call the attention of crystallographic workers to the potentialities of the Fourier transform method of working out crystal structures. Almost everything in this small book can be found in the published literature but nevertheless it will be a useful contribution if it succeeds in making more structure workers realize the potentialities of the Fourier transform approach to structure determination. The pertinent theory is presented precisely and clearly. While Professor Lipson is naturally very interested in the use of optical

methods for studying the Fourier transform of assumed structures, it will probably be true that the real utility of this book will be getting people to think in terms of Fourier transforms rather than in stimulating the use of the optical approach.

In a sense this book appears some years too late. The optical methods which have so far been proposed lend themselves only to two-dimensional analyses. Structures which can be solved with the two-dimensional approach can today more easily be solved by using the high-speed computers now available. Even five years ago this statement would not have been quite so true.

It is a pity that the thought and care which went into the writing of the book did not extend to its proofreading. A rather cursory first reading of the book showed many typographical errors, all of them so obvious they need not be listed.

In spite of these critical comments this book is recommended to both students and structure workers. A thorough study of this volume will be repaid by a better understanding of the relation between the intensity of diffraction phenomena and the diffracting structure.

The Physics of Intermediate Spectrum Reactors. Edited by J. R. Stehn. 38 chapters. UC-81. Naval Reactors Branch, Div. of Reactor Development, US Atomic Energy Comm., 1958. Paperbound. *Reviewed by David Okrent, Argonne National Laboratory.*

INCLUDED in this volume is a fairly complete compilation of the work performed by a very productive reactor physics group in the course of design of the intermediate reactor which powers the submarine *Seawolf*. As such, a somewhat more appropriate title might be "The Physics of an Intermediate Reactor". However, many interesting and practical theoretical and experimental techniques are described under one roof, herein, providing a volume of some value. In addition, as a record of the extensive efforts required for the design of a high-performance, mobile reactor, this volume serves a useful purpose.

The volume is divided into four main parts, as follows: (1) Investigation of Reactor Characteristics by Critical Assemblies, (2) Reactivity Effects Associated with Reactor Operation, (3) Heat Generation and Nuclear Materials Problems, and (4) Reactor Kinetics and Temperature Coefficients.

The first part includes a discussion of a variety of techniques of general interest for critical experiments such as inverse multiplication measurements, rod drop and other methods for control rod calibration, and foil activations for flux and spectral determinations. The second part consists primarily of calculations and experiments pertinent to a specific reactor design, except for a brief treatment of the prediction of fission product poisoning by the statistical model of the nucleus and a fairly extensive study of the burnable poison problem for intermediate reactors. In Part 3 extensive