mittee and the Council of the Indian Botanical Society are to be congratulated on the undertaking and its accomplishments.

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Physics

Solid State Physics. Advances in research and application. vol. 15. Frederick Seitz and David Turnbull, Eds. Academic Press, New York, 1963. xvi + 505 pp. Illus. $16.50.

Volume 15 of this distinguished series continues the traditions established by its predecessors. Each volume is a pot-pourri of specialized review articles, all written by recognized authorities, with the only unifying theme being the individual excellence of the articles. Any attempt to review such a book, in the sense of a critical evaluation, must be considered the height of folly, and so all we shall do here is detail the contents.

An exposition and review of the dynamical theory of x-ray diffraction, by R. W. James, constitutes fully one-third of the volume. The geometrical theory, which treats the diffraction of an x-ray beam by the geometrical array of the atoms in the crystal, is reviewed briefly and its inadequacies detailed. The dynamical theory, which worries about the interactions between the scattered waves and the crystal lattice, and with each other, is developed in a general form. The special cases of thick, relatively nonabsorbing crystals and crystals of finite thickness are considered in detail. James concludes with a brief section on the experimental implications of the theory.

In a shorter article, F. Stern treats the elementary theory of the optical properties of solids. Starting with Maxwell's equations, the Kramers-Kronig relations are developed, along with the relevant sum rules, and applied to the specific cases of the free-electron gas and the optic modes of ionic crystals. The free-electron gas receives most of the author's attention, since he discusses in some detail the wavelength-dependent dielectric constants.

An article with a more experimental viewpoint is the one by L. C. Hebel, who reviews the ideas of spin temperature and nuclear relaxation. The theory of this "semiequilibrium" statistical method—that is, the spin system is in internal equilibrium but not in equilibrium with the lattice—is covered in some detail. The method is then clarified and justified by considering such diverse phenomena as spin calorimetry, quadrupolar coupling, adiabatic demagnetization, and spin-lattice relaxation in metals, impure metals, and alkali halides.

Recent developments in the theory of electron-phonon interactions are considered in a charmingly written article by L. J. Sham and J. M. Ziman, who introduce a new member to the library of pseudoplane waves (OPW and APW). This is the pseudoplane wave (χPW), an eigenvector of the Hamiltonian with pseudopotential, and it is used throughout the discussion of rigid ion calculations. The intricacies of screening, exchange, and deformation potentials are considered briefly, and the authors conclude with a short section on experimental observations of the electron-phonon interaction, including estimates of superconducting behavior derived from liquid metal resistivities.

The volume is rounded out by P. Borelius' compendium of the temperature dependencies of specific heat, thermal expansion, and electrical resistivity, particularly in the vicinity of phase changes, for several of the elements.

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Rare Earth Research

Progress in the Science and Technology of the Rare Earths. vol. 1. LeRoy Eyring, Ed. Pergamon, London; Macmillan, New York, 1964. vi + 532 pp. Illus. $17.50.

The lanthanide rare earths contain more than one-fifth of the known metals of the Periodic Table, and if the actinide rare earths are included, these two groups comprise more than 30 percent of the known elements.

The lighter rare earths have been known for more than a century, and a considerable industry was developed around lanthanum, cerium, and the mixed rare earths, since these substances could be purified readily by conventional chemical processes. Although the lanthanides are not rare in nature, they always occur as mixtures, and the remaining members of the rare-earth series are extremely difficult to separate by ordinary chemical processes. With the discovery and development of the ion-exchange processes some 15 years ago, pure compounds of these elements became generally available. Scientists in many diverse fields quickly recognized that this availability gave them a powerful new set of tools which could be used in their basic researches and that these elements had many potential new applications for industry. As a result, a demand for pure compounds of the rare earths developed, and a number of companies started to produce them at reasonable prices. Contrary to a misconception widely prevalent before the war, the rare earths are not all alike.

In recent years a very large number of publications involving the rare earths, which cover a wide range of scientific fields, have appeared each month in the scientific literature, and periodic reviews of these fields are needed. Several reviews have been published—*The Rare Earths*, edited by Spedding and Daane; *Rare Earth Alloys*, edited by Gschneidner; and *Elé ments des Terres Rares (ou Lanthanides) Scandium, Yttrium*, edited by Loriers, Gaume-Mahn, and la Blanchetais—but the volume of literature is so great that the need continues.

The purpose of this book is to present a number of reviews written by well-known scientists in the field. The editor states in his introduction that "This volume presents the first of a series of surveys which will be prepared on an annual basis and, to provide a firm foundation for future volumes, the present work covers the years 1955 to 1961."

The surveys are "Aspects of the geochemistry of the rare earths," by L. H. Ahrens (with 72 references); "Mass extraction and separation," by K. J. Bril (356 references); "The separation of rare earths by ion exchange," by Jack E. Powell (74 references); "Liquid-liquid extraction of the rare earths (excluding the use of phosphorus based extractants)," by Boyd Weaver (9 references); "Fractionation of rare earths by liquid-liquid extraction using phosphorus-based extractants," by D. F. Peppard (37 references); "Solution chemistry," by P. Krumholz (304 references); "Recent Soviet research on the chemistry of rare earth complexes," by D. I. Ryabchikov and E. A. Terentyeva (80 references); "Kristallchemie der Oxide der Seltenen Erden," by

G. Brauer (65 references); "Phase equilibria studies in mixed systems of rare earth and other oxides," by R. S. Roth (52 references); "Crystal chemistry of rare earth sesquioxides, aluminates, and silicates," by Israel Warshaw and Rustum Roy (34 references); "Structural and physical properties of alloys and intermetallic compounds," by Karl A. Gschneidner, Jr. (139 references); "Composés Minéraux et Organiques," by F. Gaume-Mahn (255 references); "Thermodynamic and magnetic properties of the rare earth chalcogenides," by Edgar F. Westrum, Jr. (264 references); "La Chimie Analytique des Terres Rares," by Jean Loriers (253 references); "Soviet research on analytical chemistry of the rare earths," by D. I. Ryabchikov and V. A. Ryabukhin (136 references); and "Uses and applications," by Richard M. Mandle and H. H. Mandle (864 references).

The reviews give the reader a condensed survey of the literature in the areas mentioned and for the time covered (1955 to 1961). Many of the surveys overlap, and it is interesting to note that, among the contributors who treat the same subject, there is a wide divergence in the literature cited and emphasized. It is unfortunate, however, that publication of the book has been so long delayed; in the last 3 years new work equal to the amount covered in this volume has appeared in the literature.

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New Books

Mathematics, Physical Sciences, and Engineering

Abelian Categories. An introduction to the theory of functors. Peter Freyd. Harper and Row, New York, 1964. 176 pp. Illus. $7.

Advances in Chemical Physics. vol. 6. I. Prigogine, Ed. Interscience (Wiley), New York, 1964. 516 pp. Illus. $17.50. Nine papers: "Toward an analytic theory of chemical reactions," by H. Aroeste; "Electron gas in a lattice of positive charges," by A. Bellemans and M. de Leener; "On the thermodynamics of surface systems," by J. Christer Eriksson; "The critical region," by M. Fixman; "The equation of state of the classical hard sphere fluid," by H. L. Frisch; "Studies in the kinematics of isothermal diffusion: A macrodynamical theory of multicomponent fluid diffusion," by O. Lamm; "Many-electron theory of atoms,

molecules, and their interactions," by O. Sinanoğlu; "Ionic solvation," by J. Stecki; and "Melting mechanisms of crystals," by A. R. J. P. Ubbelohde.

Basic Methods in Transfer Problems. Radioative equilibrium and neutron diffusion. V. Kourganoff and I. W. Busbridge. Dover, New York, 1963. 297 pp. Illus. Paper, $2. A reprint of the volume published by Oxford Univ. Press, 1952.

Behavior of Electrons in Atoms. Structure, spectra, and photochemistry of atoms. Robin M. Hochstrasser. Benjamin, New York, 1964. 174 pp. Illus. Paper, $1.95; cloth, $3.95.

Calculation of Thermal Stresses in Nuclear Reactors. Iosif Izrailevich Gol'denblat and Nikolai Aleksandrovich Nikolaenko. Translated from the Russian edition (Moscow, 1962). Consultants Bureau, New York, 1964. 84 pp. Illus. Paper, $15.

Cathode Processes in the Mercury Arc. I. G. Kesaev. Translated from the Russian edition (Moscow, 1961). Consultants Bureau, New York, 1964. 363 pp. Illus. $17.50.

Design and Performance and Centrifugal and Axial Flow Pumps and Compressors. André Koviáts. Pergamon, London; Macmillan, New York, 1964. 484 pp. Illus. $15.

Differential Equations: A Modern Approach. Harry Hochstadt. Holt, Rinehart, and Winston, New York, 1964. 302 pp. Illus. $6.50.

Dispersion and Absorption of Sound by Molecular Processes. Course 27, *International School of Physics "Enrico Ferini."* Academic Press, New York, 1963. 457 pp. Illus. $17. Eighteen lectures.

Effects of Radiation on Materials and Components. John F. Kircher and Richard E. Bowman, Eds. Reinhold, New York; Chapman and Hall, London, 1964. 702 pp. Illus. $22.50.

Foundations of General Topology. William J. Pervin. Academic Press, New York, 1964. 221 pp. Illus. $7.95.

Friedel-Crafts and Related Reactions. vol. 2, pts. 1 and 2, *Alkylation and Related Reactions.* George A. Olah, Ed. Interscience (Wiley), New York, 1964. pt. 1, 688 pp.; pt. 2, 230 pp. Illus. Set, $50.

Generalized Functions. vol. 1, *Properties and Operations.* I. M. Gel'fand and G. E. Shilov. Translated from the Russian edition (1958) by Eugene Saletan. Academic Press, New York, 1964. 441 pp. Illus. $12.

Identification and Analysis of Surface-Active Agents. By infrared and chemical methods. 2 volumes. Dieter Hummel. Translated from the German edition (München, 1962) by E. A. Wulkow. Interscience (Wiley), New York, 1964. Text volume, 400 pp.; spectra volume, unpaged. Illus. $20.

Inertial Guidance Sensors. J. M. Slater. Reinhold, New York; Chapman and Hall, London, 1964. 231 pp. Illus. $11.

Laplace and Fourier Transforms for Electrical Engineers. Edward J. Craig. Holt, Rinehart, and Winston, New York, 1964. 528 pp. Illus. $13.50.

Laser Abstracts. vol. 1. A. K. Kamal. Plenum Press, New York, 1964. 185 pp. $12.50.

Lectures on Differential Geometry. Shlomo Sternberg. Prentice-Hall, Englewood Cliffs, N.J., 1964. 408 pp. Illus. $16.

Linear Programming. Robert W. Llewellyn. Holt, Rinehart, and Winston, New York, 1964. 383 pp. Illus. $9.

Masers et Lasers. Voyages au pays de l'électronique quantique. Michel-Yves Bernard. Presses Universitaires de France, Paris, 1964. 156 pp. Illus. Paper.

Mathematical Conversations. pts. 1–3. E. B. Dynkin and V. A. Uspenskii. Translated from the first Russian edition (1952). pt. 1, *Multicolor Problems,* translated by Norman D. Whaland, Jr., and Robert B. Brown (72 pp., $1.65); pt. 2, *Problems in the Theory of Numbers,* translated by Norman D. Whaland, Jr., and Michael B. P. Slater (125 pp., $2.35); pt. 3, *Random Walks,* translated by Norman D. Whaland, Jr., and Olga A. Titelbaum (88 pp., $2). Heath, Boston, 1964. Illus. Paper.

Matrix Algebra for Electrical Engineers. R. Braae. Pitman, London; Addison-Wesley, Reading, Mass., 1964. 174 pp. Illus. $4.50.

Noble Gases and Their Compounds. G. J. Moody and J. D. R. Thomas. Pergamon, London; Macmillan, New York, 1964. 70 pp. Illus. $2.

Nuclear Power Plants. Design, operating experience, and economics. Robert L. Loftness. Van Nostrand, Princeton, N.J., 1964. 560 pp. Illus. $12.50.

Nuclear Radiation Detection. William J. Price. McGraw-Hill, New York, ed. 2, 1964. 440 pp. Illus. $12.75.

The Nuclear Reactor. Alan Salmon. Methuen, London; Wiley, New York, 1964. 144 pp. Illus. $3.

Opticks. Or a treatise of the reflections, refractions, inflections and colours of light. Isaac Newton. Dover, New York, 1964. 524 pp. Illus. Paper, $2.25. A reprint of the fourth edition, London, 1730.

Organic Chemistry. David A. Shirley. Holt, Rinehart, and Winston, New York, 1964. 960 pp. Illus. $10.75.

Partial Differential Equations of Mathematical Physics. vol. 1. A. N. Tychonov and A. A. Samarski. Translated from the Russian edition (Moscow, 1959) by S. Radding. Holden-Day, San Francisco, Calif., 1964. 390 pp. Illus. $11.75.

Perturbation Techniques in Mathematics, Physics, and Engineering. Richard Bellman. Holt, Rinehart, and Winston, New York, 1964. 128 pp. Illus. $3.75.

Real Numbers. Stefan Drobot. Prentice-Hall, Englewood Cliffs, N.J., 1964. 112 pp. Illus. $3.95.

Rings and Homology. James P. Jans. Holt, Rinehart, and Winston, New York, 1964. 96 pp. Illus. $3.25.

Sampling Systems Theory and Its Application. vols. 1 and 2. Ya. Z. Tsypkin. vol. 1, translated from the Russian edition (Moscow, 1958) by R. C. Hutchison (392 pp.); vol. 2, translated from the Russian edition (Moscow, 1958) by A. Allan (374 pp.). I. Cochrane, Ed. Pergamon, London; Macmillan, New York, 1964. Illus. Set, $30.

The Theory of Branching Processes. Theodore E. Harris. Springer, Berlin, 1963; Prentice-Hall, Englewood Cliffs, N.J., 1964. 246 pp. Illus. $9.