

The author reviews relativistic quantum mechanics, discusses space-time symmetries and then analyzes weak interactions in detail. The presentation includes the decay of leptons and hadrons. There are chapters on the leptonic and nonleptonic decays of the hadrons, both without and with strangeness change. The K_1^0 - K_2^0 problem is analyzed and the need for the intermediate boson is discussed. The book concludes with a list of suggested experiments, many of which have already been carried out.

Because the author attempts to instruct and enlighten his audience in terms of the then current literature, there is emphasis on theoretical treatment that is no longer adequate. For instance, much of the presentation is based on the Sakata model, since unitary symmetry and its consequences had not yet been developed. The book is not too useful for the initiate, nor as a self-learning tool. Thus, the basis for the V-A theory receives little attention, and there appear many factual statements that are not explained adequately.

The translation is good and the index and references are adequate. However, the print is so small as to make long reading periods uncomfortable.

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A particle theoretician, E. M. Henley is a member of the physics faculty at the University of Washington in Seattle.

Linear boundary values

PROBLEMS OF MATHEMATICAL PHYSICS. By N. N. Lebedev, I. P. Skalskaya and Y. S. Uflyand. Transl. from Russian by Richard A. Silverman. 429 pp. Prentice-Hall, Englewood Cliffs, New Jersey, 1965.

by **T. Teichmann**

Linear boundary-value problems constitute a substantial portion of mathematical physics, and have received a corresponding amount of attention in both textbooks and reference works. Because of the power of the methods involved, and the general degree of sophistication which has become current in most modern presentations, there has been a tendency to reduce

the number of problems presented to the most well known; and to leave the others, if at all mentioned, as exercises for the reader. From the conceptual point of view this is completely satisfactory, and avoids too heavy volumes! In many applications, however, it is desirable to have available details of both techniques and problems that are not always easily found in standard works. This volume, by several well known applied mathematicians from the Physico-Technical Institute in Leningrad, helps to cover this area.

It consists essentially of a series of linear-boundary or initial-value problems of classical physics, together with hints for their solutions and specific answers, as well as a section of detailed solutions of those problems which seem to require it. The problems are generally of the kind one might expect to encounter in practical situations, rather than those aimed at the ingenuity of the reader. Worthy of special comment are a number of problems solved by conformal transformation (in particular Schwartz-Cristoffel's) and problems in all fields involving wedges, slots, bosses, etc. There is also a short, but useful supplement (written by E. Reiss) on approximate methods of solution. This book could serve as a useful supplement to a general course emphasizing conceptual problems, but will probably be of greatest value as a reference for the practicing applied mathematician or physicist working with classical problems.

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The reviewer, a theoretician with General Dynamics Corporation, has worked for a number of years on the application of mathematical methods to problems in both classical and radiation physics.

Crystals and quantum mechanics

THEORETISCHE FESTKÖRPERPHYSIK, VOLUME 1. By Albert Haug. 518 pp. Franz Deuticke, Vienna, 1964.

by **Hans J. Hagger**

A large number of books on solid-state physics has been published since the rapid evolution of this field.

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Edited by **D. ter Haar**, University of British Columbia, Canada. This popular series of paperbacks covers major theoretical developments and current practical applications in the physical sciences.

NUCLEAR FORCES by **D. M. Brink**, Oxford University. Investigates developments since 1932, including original papers on current topics. 1965 244 pp. \$3.50

KINETIC THEORY, Volume 1—The Nature of Gases and of Heat by **S. G. Brush**, Livermore, California. Includes both classical and modern accounts. 1965 192 pp. \$2.95

MEN OF PHYSICS: L. D. LANDAU. Volume 1: Low Temperature and Solid State Physics by **D. ter Haar**. Covers his classic papers and the implications of these discoveries. 1965 206 pp. \$2.95; Volume 2: Irreversible Processes In prep.

THE VELOCITY OF LIGHT by **J. H. Sanders**, Oxford University. Recent developments in the measurement of velocity, plus history and future trends. 1965 154 pp. \$2.95

EARLY ELECTRODYNAMICS. The First Law of Circulation by **R. A. R. Tricker**, England. Traces theory to its origins. Includes translated extracts of classical investigations. 1965 217 pp. \$2.95

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All these publications were based mainly on certain results in the physics of metals and semiconductors. They aimed to explain the facts and their interrelationship to quantum-mechanical behavior of waves and charged particles in periodic lattices, but due to space restrictions these books did not entirely clarify the field in toto. Haug, a theoretical physicist, has started, with this first volume of his *Theoretical Solid-State Physics*, a construction on a sound basis, related to the methods of theoretical physics and quantum mechanics.

In the first section the author describes the fundamentals of solid-state physics, crystal lattices and the electric potentials therein. In section 2 the behavior of electrons in crystals is dealt with, starting in the first chapter with the one-electron approximation, which discloses in most cases the general properties of a solid-state structure. Band structure is derived from the behavior of a single electron in a periodic potential field that is in a one-dimensional crystal model as described by Kronig and Penney, but other methods useful for the case of more than one dimension—linear combination of atomic orbitals (LCAO-method), orthogonalized atomic orbitals (OAO-method) and others—are discussed. This chapter then continues with electron statistics, the equations of electron motion in a solid-state structure and the concept of effective mass. Band-band transition under strong field, radiation and emission conditions are discussed in detail. This first chapter is closed with a short consideration of contact phenomena. In the next chapter of the second section the one-electron approximation is extended to many electrons. Again the author considers two different points of view, the Bloch scheme where the electrons move in the periodic lattice potential, independently of the lattice particles and the Heitler-London scheme, which describes the electrons by atomic functions. Chapter 3 deals with the forces which form the crystal lattice, both in the quantum-mechanical formulation and in the classical description by Mie and Grueneisen. Metal crystals, ionic crystals, molecular crystals and valence forces are considered in detail. Chap-

ter 4 describes the magnetic properties of solid-state structures, para- and diamagnetism of atoms, free electrons, solid-state materials, ferromagnetism and antiferromagnetism. The fifth chapter then deals with dielectric properties of solid-state structures, both from the classical and from the quantum-mechanical point of view and also contains a paragraph on ferroelectricity.

In the third section the author considers the crystal lattice alone. Its potential energy is assumed as given, and the lattice points oscillate around its equilibrium position. A consideration of static and dynamic behavior of the crystal lattice leads to the principles of elasticity on one side and to the phonon phenomena on the other. With this basis, lattice oscillations are treated in extenso, and thermodynamic relations to heat parameters of the crystal are derived.

In two appendices the fundamentals of classical and quantum statistics and some mathematical relations are given. Only a list of fundamental books is given, and some references to derivations and proofs not given in the book are added to the appropriate paragraphs. A list of symbols and numerical values of constants as well as a subject index are included.

Haug's book is an excellent treatise on theoretical solid-state physics. It assumes that the reader is familiar with certain methods of theoretical physics and quantum mechanics. It gives most of the derivations of the theory considered and refers to literature only for further studies. The content of the book exceeds the amount of matter treated in solid-state courses, and will thus be most valuable for the solid-state physicist as a sound basis of the subject, provided he has a very good knowledge of the German language. In the reviewer's opinion, Haug's book is the best and most extensive modern theoretical publication on solid-state physics, and we would be very glad to have the second volume, dealing with electron-lattice interaction, luminescence and superconductivity, not too far in the future.

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A specialist in electricity and electron physics, Hans J. Hagger is associated with Albiswerk/Zurich.

BOOKS RECEIVED

ACOUSTICS

Physical Acoustics. Principles and Methods. Vol. III, Part B, Lattice Dynamics. Warren P. Mason, ed. 336 pp. Academic Press, New York, 1965. \$12.00.

ASTRONOMY & ASTROPHYSICS

Galactic Structure. Adriaan Blaauw and Maarten Schmidt, eds. 606 pp. University of Chicago Press, Chicago, 1965. \$15.00.

Neutrino Astrophysics. By Hong-Yee Chiu. 107 pp. Gordon and Breach, New York, 1965. Cloth \$5.00, paper \$2.50.

Progress in Radio Science 1960-1963. Vol. V. Radio Astronomy. Report of Commission V during the XIV URSI General Assembly. (Tokyo, Sept. 1963). E. Herbays, ed. 140 pp. American Elsevier, New York, 1966. \$12.50.

The First Book of Mars. An Introduction to the Red Planet. By David C. Knight. 96 pp. Franklin Watts, New York, 1966. \$2.65.

Structure and Evolution of the Stars. By Martin Schwarzschild. 296 pp. (Reprint of 1958 ed.) Dover, New York, 1965. Paper \$2.25.

Interstellar Gas Dynamics. (2nd ed.) By S. A. Kaplan. F. D. Kahn, ed. 126 pp. Pergamon Press, New York, 1966. \$6.50.

Solar Radiation. N. Robinson, ed. 347 pp. American Elsevier, New York, 1966. \$24.50.

ATOMIC & MOLECULAR PHYSICS

Optical Pumping. An Introduction. By Robert Bernheim. 272 pp. W. A. Benjamin, New York, 1965. \$9.00.

The Electronic Evolution in the Atoms of the Elements and the Construction of a New Periodic Table. By P. Y. Loung. 72 pp. Periodex Scientific Co., Palo Alto, Calif., 1965. Paper \$5.00.

The Fundamental Atomic Constants (2nd ed.). By J. H. Sanders. 98 pp. Oxford University Press, Oxford, 1965. Paper 12s. 6d.

The Structure of Atoms and Molecules. By V. Kondratyev. Transl. from Russian by G. Yankovsky. 530 pp. Dover, New York, 1965. Paper \$2.50.

BIOPHYSICS & MEDICAL PHYSICS

Radiological Monitoring of the Environment. Conf. Proc. (Berkeley, Gloucestershire, Oct. 1963). B. C. Gobold and I. K. Jones, eds. 425 pp. Pergamon, New York, 1965. \$17.50.

The Machinery of Life. By Dean E. Wooldridge. 212 pp. McGraw-Hill, New York, 1966. \$7.95.

Vision. Biophysics and Biochemistry of the Retinal Receptors. By Jerome J. Wolken. 193 pp. Charles C. Thomas, Springfield, Ill., 1966. \$9.50.