

physical significance. Professor Mercier, in the volume under review, has presented a systematic formal treatment of classical mechanics of both particles and fields.

The first two chapters deal with the Lagrangian formalism applied to particles and fields, respectively. This procedure is repeated in Chapters 3, 4, and 5 with respect to the Hamiltonian canonical formalism. There is a long chapter on transformation theory. Much of the material will of course be found in the standard treatises, but it is organized with unusual coherence and generality. Thus relativity is introduced very early, and tensor analysis is used freely. Probably the outstanding value of the book is to be found in the treatment of field theory, in which Lagrangian and Hamiltonian densities are clearly introduced and discussed. The applications here are, to be sure, limited largely to electromagnetic fields and there is no discussion of deformable solid media or hydrodynamics. The basic ideas of phase space and statistical mechanics are exhibited in connection with the canonical method.

An interesting feature of the treatment of transformation theory is the stress on both the nonhomogeneous formalism in which the time t always appears as an independent parameter and the homogeneous formalism in which time is considered simply as one among the generalized coordinates q_n of the system in question. The latter leads directly to a consideration of charge, parity, and time inversions and the so-called CPT theorems.

The text is illustrated by numerous problems, mainly mathematical in character. The style though in general clear is somewhat compact and abbreviated and there are some stylistic quaintnesses. The book should prove useful to theoretical students who can handle advanced analytical mechanics and are on their way to research in quantum mechanics.

Solid State Physics: Advances in Research and Applications, Vol. 9. Edited by Frederick Seitz and David Turnbull. 548 pp. Academic Press Inc., New York, 1959. \$14.50. *Reviewed by Hans Jaffe, Clevite Research Center.*

VOLUME 9 of *Solid State Physics* covers a number of divergent but important subjects. Not all of these enjoy the limelight of present-day solid-state activity. This very diversity makes the volume stimulating to study.

The first article, by H. C. Wolf (Stuttgart), 80 pages, deals almost entirely with the near-ultraviolet absorption and fluorescent spectra of aromatic hydrocarbons. It gives a leisurely description of experimental methods and results, followed by a rather qualitative theoretical treatment. The exciton concept is used only with considerable caution. A chapter by W. W. Scanlon (Naval Ordnance Laboratory), 57 pages, gives an excellent account of the semiconducting properties of lead sulfide and its isomorphs, lead selenide and lead telluride, in whose study the author has had a prominent part. These crystals are chosen as examples for polar

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crystals because their low-energy gap and hence large electric conductivity make measurements relatively easy. The word "polar" in the title of this article denotes a compound semiconductor with considerable difference in electronegativity of the components. The reviewer would prefer this word to be reserved for compounds which are not centrosymmetric, especially the III-V and II-VI semiconductors of sphalerite and wurtzite type.

In a chapter on static electrification of solids, 58 pages, D. J. Montgomery (Michigan State University) brings quantum theory to bear on the subject of the very first experiments in electricity. His basic assumptions are equality of the Fermi levels for the interior of substances in frictional contact, and partial leakage of charge immediately after contact separation by tunnel effects. So far, theory provides a program rather than a set of predictions that can be checked by experiments. Those who remember triboelectric series in their ancient textbooks showing metals generally on the negative end (gaining electrons on rubbing) will be reassured by recent experiments which spread the metals within the series, those of low work function being near the positive end. Some modern polymers, including polyethylene and Teflon, become negative by rubbing even with platinum.

E. Heer (University of Rochester) and T. B. Novey (Argonne) review the interdependence of solid-state physics and angular distribution of nuclear radiation in 55 pages. Emphasis is placed on the angular correlation of successive nuclear radiation events. While most of the work described was undertaken to obtain information on properties of nuclei, the authors believe that these methods are useful for the determination of magnetic fields or electric field gradients at the position of the radioactive nucleus.

A. H. Kahn and H. Frederikse (National Bureau of Standards), 34 pages, give an introduction to the theory of oscillatory susceptibility and transport properties. Experimental data relate largely to bismuth.

Andre Guinier (Paris), 104 pages, discusses the study of heterogeneity of solid solution metal crystals by x-ray diffraction, a field to which he has been a leading contributor. The scope of this article is indicated by its first paragraph: "In this article, we will discuss the structure of metallic solid solutions which, to a first approximation, are *homogeneous, disordered* substitutional solutions. More precisely, the alloy appears as a single phase in classical examinations with microscopy or x-rays. We will consider only the case in which no long-range order exists; thus we will not treat the order-disorder transition, which has been the object of a previous article of this series." The disorder caused by substitution of atoms of different size is not cumulative over distances large compared to the atom diameter. It causes diffuse scattering of x rays but the Bragg reflections remain sharp. Guinier's article gives a great deal of information on the physical properties and kinetics of the systems studied by his methods.

The concluding article by D. S. McClure (RCA), 127

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pages, once more deals with electronic spectra, but this time of ions or ion complexes subject to strong crystalline fields. The article does not include spectra involving valence electrons, which must be treated by band theory, and is thus concerned primarily with salts of the transition metals and rare earths. The theory is developed by means of symmetry group representation but remains semiempirical to account for the large amount of experimental data available. The experimental part is quite readable without complete study of the theory.

Few individuals will read this volume from cover to cover, but considering the excellence of writing, the high standard of print and illustrations, and the reasonable price this is another "best buy" in this series.

Struktur der Materie. Vol. 2 of *Lehrbuch der Theoretischen Physik* (2nd Revised Ed.). By Walter Weizel. 1793 pp. Springer-Verlag, Berlin, Germany, 1958. DM 88.00. Reviewed by Nicholas Chako, Queens College.

A BROAD field of physical phenomenon based on the microscopic theory of matter is dealt with in Prof. Weizel's second volume on theoretical physics. He treats in a comprehensive manner the mathematical analysis of a variety of topics ranging from atomic, molecular, and nuclear structure and spectra to thermal, electrical, and other properties of matter, all centered around the principles of quantum mechanics.

Broadly speaking, the treatise may be classified into four main divisions: (a) quantum mechanical analysis of atomic and molecular spectra, including Dirac's theory, (b) field theory and nuclear structure, (c) quantum chemistry and statistical mechanics, and (d) thermal, electrical, and other properties of the gaseous, liquid, and solid states of matter. There are also chapters on ion and electron optics, crystal structure, lattice theory of metals, and semiconductors.

In the first part, the author stresses the mathematical methods for the determination of atomic and molecular spectra and places less emphasis on the physical and mathematical foundations and development of quantum mechanics and the description of the results deduced from the theory. This part does not deviate very much from other texts on this subject (there are a few exceptions) where physical concepts and interpretations of the results of mathematical analysis, as well as philosophical implications, are relegated to a secondary role. This is to be regretted, since the mathematical treatment of these problems is clearly and thoroughly presented. On the other hand, the chapters devoted to field theory are well executed and constitute one of the best presentations of the subject to be found in any of the existing treatises of this kind. The sections on nuclear structure (physics) contain a good introduction for further reading. There is also an extensive treatment of molecular phenomena and chemical bonds and quantum statistics. In the fourth part, the author discusses with considerable care thermal, electrical, and optical properties of gases and solids, transport phe-