

The authors, professors of physics and astrophysics at the University of Colorado, suggest in their preface that the material is designed for an introductory physics course. I should add that it is a rigorous introduction and that much of the material in Volume 2 is presented on a level that makes it quite suitable for use in the sophomore year.

Although the quality of work throughout is generally excellent, there are sometimes unclear figures or photographs. For example, a multiple-flash

photograph of a falling weight is displayed for use in measuring g . Displacements measured from the photograph are in poor agreement with the results given in the answer frame of the text. A figure used to illustrate infinitesimal rotations is almost impossible to interpret. These are minor annoyances, however, and do not detract seriously from an otherwise fine presentation.

The programmed approach is an intriguing one; the student is drawn into an involvement with the material that

he would be unlikely to achieve with a conventional text. Neil Ashby and Stanley Miller have provided us with a timely and rigorously presented selection of material. It will be interesting to see how well programmed texts such as these succeed in the many new physics courses being developed in our colleges and universities.

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Seitz and Turnbull, 1967

SOLID STATE PHYSICS, VOL. 19.
Frederick Seitz, David Turnbull, eds.
381 pp. Academic Press, New York,
1967. \$16.00

by Henry M. Otte

As did its recent predecessors, this volume again contains four articles, well written and extensively documented. Two of the articles are concerned with the effects on solids of high pressures, in the one case static and in the other case dynamic; both report and review primarily experimental observations. Reviews on the effects of high pressures have appeared in Volumes 6 (1958), 11 (1960), 13 (1962) and 17 (1965). The emphasis in the other two articles is on theoretical analysis as the principal tool to calculate desired measurable quantities from the mathematical formulation of a physical process. They deal with the effects of crystal imperfections on lattice vibrations and with the interaction between acoustic phonons and conduction electrons. Reviews dealing with aspects of both subjects can be found in previous volumes.

The first and longest article is by A. A. Maradudin (Westinghouse Research Laboratories). Entitled "Theoretical and Experimental Aspects of the Effects of Point Defects and Disorder on the Vibrations of Crystals," it forms the concluding half of his review. The first half appeared in Volume 18 (1966) and together the two halves would have filled a separate volume or supplementary monograph. Maradudin makes numerous references to, and presents the results of work previously unpublished in the open literature. The main sections of part



FREDERICK SEITZ AND DAVID TURNBULL edited *Solid State Physics* since Vol. 1 was published (1955). With Vol. 20 (1968) Henry Ehrenreich joins them.

two of Maradudin's article cover impurity-induced infrared lattice absorption in crystals, anharmonic effects in impurity-induced one-phonon infrared lattice absorption, localized modes and spin-lattice interactions and lastly the surface of a crystal considered as a defect. It is clear that in many cases one requires more sophisticated models of the impurity atom than that which represents it simply as a particle whose mass differs from that of the atom it replaces. Otherwise the arguments will be only qualitative and semiquantitative. Maradudin concludes that future work will be concerned, among other things, with explaining experimentally observed effects in which the vibrations of impurity atoms play a role and with theoretical analyses in which the basic approximations (namely, the harmonic approximation and the cyclic boundary condition) are relaxed and directed to maintaining a sustained effort to make the theory of defect atom vibrations more than just a rather elegant mathematical exercise.

"X-ray Diffraction Studies of the Lattice Parameters of Solids under Very High Pressure" is a review by H. G. Drickamer, R. W. Lynch, R. L. Clendenen and E. A. Perez-Albuernie discussing primarily measurements of lattice parameters versus pressure, P , made in Drickamer's laboratory at the University of Illinois. The results are described in terms of Murnaghan's equation

$$P = \frac{B_0}{B_0'} \left[\left(\frac{V_0}{V} \right)^{B_0'} - 1 \right]$$

where B_0 is the bulk modulus, B_0' its pressure derivative, both evaluated at 1 atm. pressure, and V_0/V the volume ratios. The constants B_0 and B_0' are listed for all substances where it was practical to evaluate them. Data for 23 crystals having the sodium or cesium chloride structure or slight distortions thereof are presented and discussed; they are grouped as alkali halides, miscellaneous halides, cubic oxides and sulfides, and carbides. Data and discussion is included also for two



Physics I

by **Elisha Huggins**
Dartmouth College

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tetragonal oxides not predominantly ionic and for three oxides having the rhombohedral corundum structure. Six crystals that can definitely be classified as molecular or covalent were also studied: diamond, graphite, boron nitride, iodine, stannic iodide and p-diiodobenzene. Finally, the behavior of a number of hcp, tetragonal and bcc metals and alloys are reviewed. An appendix to the paper tabulates all the values of V/V_0 , lattice parameters and pressures, which have been shown graphically in the text. The quantity of data is quite formidable; in many instances the agreement between theory and experiment is excellent.

Some parts of the paper on "Shock Effects in Solids" by D. G. Doran and R. K. Linde (Stanford Research Institute) are in the form of a literature survey rather than a critical review because, according to the authors, of the preliminary nature of many of the experiments. The discussion is oriented primarily toward the crystalline solids because these are the materials that have received by far the most attention. Considerable space is devoted to comparing shock-produced effects with changes produced by quasi-static deformation at atmospheric pressure; the differences between the two types of experiments are generally only in degree and not in kind. A brief discussion of recovery techniques and problems is included. Because metals are less easily fractured and hence more easily recovered, the majority of shock recovery work has been performed on them. Not included in the article are such topics as explosive forming, jetting, explosive welding, hypervelocity impact and shock compaction of powders. The authors seem to have done a fairly conscientious job of compiling the large amount of recent literature, both published and unpublished. However, this reviewer took exception to finding his name omitted as coauthor of a reference (number 171), quoted on pages 267 and 274!

H. N. Spector's article on "Interaction of Acoustic Waves and Conduction Electrons" places particular emphasis on the effect of dc magnetic and electric fields on the electron-phonon interaction. Spector (IIT Research Institute) restricts himself mainly to conduction electrons in

spherical energy bands, thus ignoring the effects of complicated Fermi surfaces on the interaction. The interaction of acoustic phonons with conduction electrons is responsible for most of the electrical resistance in normal metals and dominates the scattering of electrons in at least some temperature range in most semiconductors. However, it was only with the experiments of Bommel (1954) and Mackinnon (1955) on the attenuation of ultrasonic waves in the megahertz frequency range in metals that the use of acoustic waves as a tool to probe the electron-phonon interaction became feasible. The effects of this interaction on the propagation of acoustic waves in a conducting solid show up in three different ways: the attenuation of the wave, a change in the velocity of sound and the presence of an acoustoelectric field. Not dis-

cussed is the interaction in superconductors. A useful list of symbols and their meaning as employed in the article may be found at the end of it.

The excellent editorial standard is maintained. In fact, this reviewer was pleased to note that in the listing of previous volumes, the publication years are now included, a minor omission that drew comment in the review of Volume 17. In the preface to the present volume it is announced that Professor Henry Ehrenreich (Harvard University) will become a co-editor, starting with the next volume (Volume 20). Hopefully Seitz and Turnbull will continue their association with the series.

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Layman's survey

THE NEW AGE IN PHYSICS. (2nd edition) By Sir Harrie Massey. 386 pp. Basic Books, New York, 1967. \$10.00

by Jacques E. Romain

Covering in any detail the whole field of physics, even of modern physics, in a single volume would have been a well-nigh impossible task. A selection was unavoidable, and the author's choice is those fields of physics in which important progress is currently being made and which are widely advertised, namely, atomic and quantum physics, the necessary elements of relativity, nuclear energy and its applications, electrons and their applications (solid-state electronics, magnetism, superfluidity and superconductivity, plasmas, computers, masers, lasers, Mössbauer effect), particle accelerators and detectors, elementary particles and high-energy physics, cosmic rays, radio astronomy, exploration of the upper atmosphere, artificial satellites and space probes. Two noteworthy omissions are rheology and cybernetics. The author's own fields of interest may, quite legitimately, have influenced the choice. (He is well-known for his research in atomic physics and is the chairman of the British National Committee on Space Research.) Whatever the motivation,

the selection is broad enough for a single book and provides a substantial reading.

The book, of which this is the second, updated, edition, is essentially a popularization intended for the educated reader who has an intellectual background but little technical knowledge of physics and who does not care to cope with more than elementary mathematics. (As most of us are this "educated layman" in some field or other of physics, the book may be of value even to the specialist who has considerable knowledge of a limited field.) The author has a talent for writing a comprehensive, authoritative and attractive exposition. Numerous photographs and diagrams help in this respect. To be sure, not every topic is dealt with so perfectly that no reader (at least among those with an over-inquisitive physicist's mind) will be left with unanswered question. But it could hardly be otherwise without delving into technicalities. The author has taken utmost care to make his book up-to-date at its completion (1966).

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The reviewer formerly taught theoretical physics. He is presently a scientific advisor in applied mathematics and theoretical physics.