

tain a fair amount of detail and to give a picture of what can be accomplished.

It is interesting that there is probably relatively little overlap in the audiences for these three articles. This fact was true of the former volumes that are about evenly split between topics of interest in nuclear physics and those primarily for high-energy experiments. Nevertheless the series represents a worthwhile contribution to the technical literature.

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Robert R. Borchers is presently doing research in gamma-ray perturbed angular correlation and digital data-handling techniques at the University of Wisconsin, Madison.

Bell's quanta

THE PHYSICS OF LARGE DEFORMATION OF CRYSTALLINE SOLIDS, VOL. 14. By James F. Bell. 253 pp. Springer-Verlag, New York, 1968. \$12.00

by DANIEL C. MATTIS

This monograph suggests an amusing and potentially unique intersection of solid-state physics and mechanical engineering. Over a span of 20 years of research, James F. Bell, professor at Johns Hopkins' solid mechanics department, has performed thousands of experiments on dozens of varied crystalline solids ranging from rock salt to aluminum. The tests, some static and some involving the motion of large-amplitude waves in the material, had durations as short as 10^{-6} sec at strain rates of 10^5 sec $^{-1}$ and as long as 10^6 sec at strain rates of 10^{-8} sec $^{-1}$. They were conducted at temperatures as low as 4.2 K and as high as 1800 K, that is from $T/T_m = 0.003$ to 0.98, where T_m is the melting temperature of the material. From these experiments, which are the substance of this monograph, Bell derives the phenomenological law

$$\sigma = \left(\frac{2}{3}\right)^{r/2} \mu(0) B_0 \left(1 - \frac{T}{T_m}\right) (\epsilon - \epsilon_b)^{1/2}$$

where σ is the uniaxial stress and ϵ the uniaxial strain. They are referred to an initial unstressed value ϵ_b . B_0 is a constant, $\mu(0)$ is isotropic modulus, and $r = 1, 2, 3, \dots$ is a positive integer that increases by steps of unity or more, with increasing stress. Typical

experimental results are shown in the figure. Not content with quantizing r , Bell has also found that $\mu(0)$ is quantized

$$\mu(0) = \left(\frac{2}{3}\right)^{s/2+p/4} \times 2.89 \times 10^4 \text{ kg/mm}^2$$

This is a universal relation for crystalline materials, in which $s = 1, 2, 3, \dots$ is also an arbitrary positive integer and $p = 0, 1$ is a structure factor that is constant for a given material.

Does the fraction $2/3$ arise from an average, say of $\cos^2\theta$, over various orientations of microcrystalline structures? Do the "quantum numbers" r , s and p relate to the number of such microstructures? Answers based on a microscopic model are presently not available, and there are no guesses ventured in this book. The technological importance of understanding large-scale deformation of matter is obvious, and so the challenge of this book to physicists is loud and clear.

* * *

The reviewer is professor of solid-state physics at the Belfer Graduate School of Science of Yeshiva University, and has most recently coauthored an article "Magnetic Semiconductors," in the *Handbuch der Physik*.

Compound semiconductors

MONOGRAPHS IN SEMICONDUCTOR PHYSICS, VOL. 2: LIQUID SEMICONDUCTORS. (Trans. from Russian) By V. M. Glazov, S. N. Chizhevskaya, N. N. Glagoleva. 362 pp. Plenum, New York, 1969. \$22.50

by STUART A. RICE

Although the translation from the Russian is undoubtedly correct, the title of this book is misleading. To me the interesting problems in liquid semiconductors are primarily concerned with the electronic structure, the scattering processes that occur in liquids and the relation between the optical spectra of liquids and solids.

This book, on the other hand, describes thermodynamic and gross physical properties of semiconductors. It is, in fact, an extended review of the authors' work and of similar work by other investigators. The dc conductivities, the thermoelectric powers, the magnetic susceptibilities and oc-

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PHYSICS

MECHANICS, WAVES, AND THERMAL PHYSICS

by Robin L. Armstrong and James D. King,
both at the University of Toronto

A new introductory, calculus-based physics text that covers selected topics in the areas of mechanics, waves, and thermal physics.

The development of this book proceeds from single-particle motion to the motion of macroscopic systems in terms of the constituent particles. Both the classical and the relativistic points of view are considered throughout. The nature of waves is discussed as background to the introduction of quantum theory. Statistical concepts are then introduced and combined with the quantum concepts to account for some of the failures of the classical theory. The text concludes with a treatment of thermodynamics.

At the end of each chapter are problems and questions based on the material in that chapter and earlier ones (a solutions manual is available).

January 1970, approx. 640 pp., \$9.95 (57181-0)

ASTRONOMY

INTRODUCTION TO ASTRONOMY, 2ND EDITION, 1970

by Cecila Payne-Gaposchkin,
Harvard College Observatory
and Katherine Haramundanis,
Smithsonian Institution

This survey of modern astronomy discusses the solar system in detail, but give equal emphasis to stellar astronomy.

Chapter on the Moon expanded in this revision to include the latest data obtained from artificial satellites. (Includes especially noteworthy photographs.)

Includes photographs of the planets especially selected and prepared at the Lowell Observatory—probably the finest group of planetary photographs in existence. (Includes the Mariner closeups of Mars.)

Chapters on stellar astronomy almost completely rewritten. Emphasizes double stars.

Describes in detail the evolution of stars, star clusters, and galaxies which are understood much more fully than when the First Edition was published.

February 1970, approx. 640 pp., \$10.25 (478107-4)

asionally the Hall coefficients of many liquids are cited, but no systematic interpretation of the measurements is given in terms of the electronic structure of the liquid. Indeed, even the interpretations of the gross physical properties, such as viscosity, are very crude and old fashioned. Perhaps this is the best that can be done considering the current state of understanding of the properties of liquid semiconductors and that the

authors devoted much attention to complicated compound semiconductors. The book is undoubtedly a useful compilation of physical-chemical data, but it remains for me a disappointment because of its lack of attention to the electronic structure of liquids.

* * *

Stuart A. Rice is with the James Franck Institute.

"There's vinegar and pepper in't"

PROBLEMS IN SOLID STATE PHYSICS. H. J. Goldsmid, ed. 466 pp. Academic, New York, 1968. \$14.50

by WALTER G. MAYER

Because the market is not exactly flooded with useful solid-state physics textbooks, instructors do not usually have volumes of worked-out problems to supplement their lectures. The present collection of about 300 problems is therefore most welcome.

The topics covered are essentially those treated in introductory courses with their complexity ranging from very simple to difficult. To arrive at some of the solutions the student needs little intuition but much mathematical patience, yet for many other exercises the requirements are just the opposite. This differing degree of difficulty is clearly indicated and reflects the authors' individual interpretations in the 16 sections.

The number of problems per section varies from five (crystal growth) to more than 50 in the two chapters on magnetism. Although a number of the problems might be considered standard fare and also found in available textbooks, it is reassuring to see that they, too, are worked out in great detail in the answer section. Yet the majority of exercises are sufficiently thought provoking and illustrative that one might well include their solutions in lecture notes. The entire material is presented clearly, is well organized and profusely illustrated, complete with subject index and many appropriate references. The notation throughout is rather standard and, in cases of possible doubt, well defined.

The editor sets the stage for the reader with a quotation from *Twelfth*

Night: "Here's the challenge, read it: I warrant there's vinegar and pepper in't." It is not an empty promise.

* * *

The reviewer is associate professor at Georgetown University and has been teaching solid-state physics since C. Kittel's first edition.

NEW BOOKS

CONFERENCE PROCEEDINGS

Lectures in Theoretical Physics: Atomic Collision Processes. Vol. XI^c. (The 11th Boulder Summer Institute for Theoretical Physics Aug. 5-Aug. 23.) Sydney Geltman, Kalyana T. Mahanthappa, and Wesley E. Brittin, eds. 337 pp. Gordon and Breach, New York, 1969. Cloth \$22.50, paper \$14.50

Lectures in Theoretical Physics: Quantum Fluids and Nuclear Matter. Vol. XI^b. (The 11th Boulder Summer Institute for Theoretical Physics July 8-July 19.) Kalyana T. Mahanthappa and Wesley E. Brittin, eds. 428 pp. Gordon and Breach, New York, 1969. Cloth \$26.00, paper \$14.50

Technology and Social Progress. (The 6th AAS Goddard Memorial Symposium March 12-March 13, 1968 Washington, D. C.)

Fuel Cell Systems-II. (5th Biennial Fuel Cell Symposium sponsored by Division of Fuel Chemistry, 154th Meeting of the American Chemical Society Chicago, Illinois, Sept. 12-Sept. 14, 1967.) Robert F. Gould, ed. 446 pp. American Chemical Society Washington, D. C., 1969. \$17.50

Lectures in Theoretical Physics: Elementary Particle Physics, Part I and II Vol. XI^a. (The 11th Boulder Summer Institute for Theoretical Physics, June 17-July 5.) Kalyana T. Mahanthappa, Wesley E. Brittin and Asim O. Barut, eds. 629 pp. Gordon and Breach, New York,

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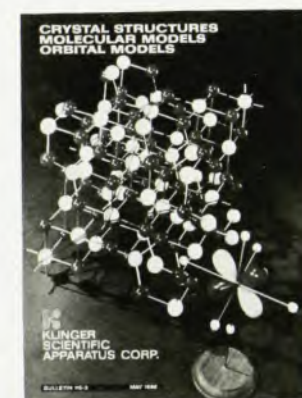
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