

today and the day before

Physics in the Twentieth Century:

Selected Essays

by Victor F. Weisskopf

foreword by Hans A. Bethe

This selection of essays covers a wide range of subjects connected with the physical sciences and their relation to human affairs. They are broadly conceived and directed to a generally interested audience rather than to specialists in particular areas. Some are written for the initiated, some are broad synopses of a branch of physics and are directed to the scientifically interested layman. Some deal with more philosophic questions such as Niels Bohr's ideas on complementarity, and others deal with the problems of science, ethics, and society.

Hans Bethe writes as follows in his foreword:

"His summary articles on special topics are lucid, and are 'popular scientific writing' at its best. The subject is made clear to physicists in other branches of physics, and to the educated public, by simplifying it, but without ever making a compromise with fundamental accuracy, as many popular writers on science do when they get enamored with their own imagery and forget the subject that they really want to explain."

\$7.95

Problems of Atomic Dynamics

by Max Born

\$2.95 (paperback)

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by Eugene P. Wigner

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Perspectives in Quantum Theory: Essays

in Honor of Alfred Landé

edited by Wolfgang Yourgrau and

Alwyn van der Merwe

\$17.50

The Character of Physical Law

by Richard Feynman

\$6.95 (\$2.45 paperback)

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on the main features of these five themes. The authors did not hesitate to omit ideas that are unnecessary for an understanding of these themes, such as fluids and Gauss's law. Topics mentioned only in the problem sets at the end of chapters include simple harmonic motion and capacitance. Over 25% of the material in the text is marked as an "extra," an interesting extension of the main theme but not essential to the continuing story. One should therefore be able to cover the book comfortably in a one-year introductory physics course. Comparing the coverage of topics with other texts, such as the three volumes of Richard T. Weidner (co-author of the text reviewed) and Robert L. Sells, one finds that a higher percentage of space is devoted to classical conservation laws, primarily at the expense of fluids, thermodynamics and optics.

The authors have tried to develop the five main themes by precise arguments and have, on occasion, used an historical approach. An example is the introduction of kinetic energy after a discussion of conservation of momentum. The *retrieval principle* (relative speed of separation equals relative speed of approach) is discussed in some detail; although it may not be very fundamental, it certainly simplifies the mathematics of elastic collision problems. The ideas of Huygens and Leibniz leading to *vis viva* are then applied to

introduce kinetic energy.

Some of the terminology used in this text is different but usually introduced for very good reasons. Gravitational mass, for instance, is initially referred to as "gravitational charge," a "magnetic charge" is also discussed. An *emf* is called *electromotance* with a footnote that the historically sanctioned but misleading term *electromotive force* is often used instead of *electromotance*.

The diagrams and illustrations are very well done, and the computer-produced electron-density pictures illustrating probability densities for various states certainly add to an understanding of quantum systems. The use of an extra color throughout the book is appealing.

I feel that the text *Physics From the Ground Up* is a valuable addition to the existing market of noncalculus introductory physics books primarily because of its somewhat different approach in discussing relatively few principles in some detail and also because of the overall quality of content as well as printing.

* * *

The reviewer has lectured in introductory physics courses at Rensselaer Polytechnic Institute for many years and has been a participant in a number of national curriculum development projects dealing with physics for nonscience majors.

Introduction to Mechanical Properties of Materials

By M. M. Eisenstadt

444 pp. MacMillan, New

York, 1971. \$14.95

Entrance into the Material Science research area at the University of Maryland is announced by a large poster hanging in the corridor. Upon leaving, one is confronted by the inscription on the back of the poster, the work of irreverent students, no doubt, announcing return to the realm of "Immaterial Science."

Since many institutions have instituted various materials-sciences programs, a well written introductory text would appear to be welcome. Melvin M. Eisenstadt, assistant professor of mechanical engineering at the University of California in Santa Barbara, has written such a text. Though most properties discussed are of general interest, by considering metals, ceramics and polymers, Eisenstadt is able to supply basic ideas in comparing similarities and differences of these materials. For example, in the chapter on molecular bonding, two sections are devoted to polymerization in addition to more commonly considered bonding mechanisms. In the third chapter, a

large section on structure is devoted to chain molecules, and the chapter on plastic behavior of solids discusses work hardening of metals, dislocation motion in ceramics and permanent deformation of polymers. This comparative approach also is evident in the later chapters.

The book is aimed at the sophomore or junior with little special preparation beyond calculus. Though this makes several of the derivations somewhat forced, the overall emphasis on conceptual model building makes the well organized material readily accessible. Eisenstadt succeeds admirably in his stated aim to pursue two goals in considering mechanical phenomena in materials. On the one hand, he presents physical, microscopic models. They serve as guides to macroscopic equations and thus lead to an understanding of why materials behave as they do. On the other hand, he considers quantitative measurements to give the engineer a feeling for the order of magnitude associated with changes in mechanical phenomena. An unusually large number of well selected figures and tables (almost one per page) help to illustrate ideas and support the text.



Work hardening in an aluminum alloy. Dislocations are shown piled up against barriers in the crystal. Such pile-ups exert back stress on the dislocation source; so that an increasing amount of shearing stress must be applied to the crystal for the source to operate, resulting in work hardening. Photo provided by Neville Carter of Earth and Space Sciences Dept. of SUNY (Stony Brook) was taken by K. C. Jain, Dept. of Engineering SUNY (Stony Brook).

Many of these were taken from the research literature and should help to give the student a feeling of a direct relation to experimental results.

The student, particularly, will find the organization of each chapter very appealing. Major concepts are identified in bold numbered sections, with questions examining conceptual understanding at the end of most sections and a summary section at the end of each chapter. Extensive problems at the end of each chapter apply ideas as well as occasionally extending them. Answers to the questions are also given as an additional learning aid.

Inasmuch as the book is introductory and descriptive, it would be helpful to find references to more detailed, advanced treatments displayed more prominently. Unfortunately, those that are given are somewhat hidden, and some effort is required to seek them out. Figure captions in small print overlap into the otherwise wide margin on the left side of the page. This physical format appears to be a distinct asset for the student.

All in all, the book is rather impressive and should find good use in the classroom.

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Far-Infrared Spectroscopy

By K. D. Möller,
W. G. Rothschild

797 pp. Wiley, New York, 1971. \$29.95

The volume under review is a well produced, 800-page compendium of information about far-infrared spec-

troscopy—defined by the authors as covering the wavelength range from fifty microns to 1000 microns. The use of these wavelengths for research purposes has increased so much in the last decade that a volume with the title *Far Infrared Spectroscopy* was certain to appear sooner or later, but it is difficult to see to whom this particular book is addressed. It is not sufficiently systematic to be suitable for student use, nor does it have enough original matter or critical content to make it appealing to specialists. The latter will find that they are continually meeting material familiar to them and which has simply been lifted out of published sources.

The authors, K. D. Möller and W. G. Rothschild, are themselves practitioners in experimental far-infrared spectroscopy; but they do not seem to have had a clear vision of what their book should contain, so they have had about one-third of the book written by other authors in the form of appendices. I deplore the practice of having hidden authors and believe that much of the material that these contributors have written is not suitable for sale in book form but should properly have been given as review articles in journals. There, not only would there be better assurance of enthusiastic scholarship on the part of the individual authors, but they would have had the benefit of critical refereeing before their work was printed. The last appendix is a "far-infrared bibliography" by E. D. Palik, whose work over the years has been much appreciated by workers in the far infrared field; but Palik's contribution would have been more appropriately presented in an inexpensive government publication, which then,

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Selected Papers of Cecil Frank Powell

Edited by E. H. S. Burhop, University College, London, W. O. Lock, CERN, Geneva, and M. G. K. Menon, Tate Institute of Fundamental Research, Bombay

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Case Studies in Atomic Collision Physics, Volume 2

Edited by E. W. McDaniel, Georgia Institute of Technology, Atlanta, and M. R. C. McDowell, Royal Holloway College, England

Contents: Three-Body Recombination of Positive and Negative Ions. Precision Measurements of Electron Transport Coefficients. Differential Cross Sections in Electron Impact Ionization. Interpretation of Spectral Intensities from Laboratory and Astrophysical Plasmas. Atomic Processes in Astrophysical plasmas. Polarized Orbital Approximations. Photodetachment: Cross Sections and Electron Affinities. The Role of Metastable Particles in Collision Processes. 1972, 632 pp., \$49.50

Many-Electron Theory

By S. Raimes, Imperial College, University of London

Contents: Resume of the Many-Electron Problem. The Occupation Number Representation (Second Quantization). The Hartree-Fock Method and Free-Electron Gas. Plasma Oscillation in a Free-Electron Gas. The Schrodinger, Heisenberg and Interaction Pictures. The Adiabatic Hypothesis and the Energy of the Ground State. Feynman Graphs. The Linked Graph Theorem. The Correlation Energy of a Free-Electron Gas. Green Functions and the One Electron Schrodinger Equation. Green Functions for Many-Electron Systems. Appendices. 1972, 286 pp., \$21.50

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