algebraic mistakes and partly because the sign of i is used inconsistently. The same inconsistency concerning i appears in the discussion of the time-dependent Schrödinger equation where, incidentally, eigenfunctions are called eigenvalues.

When the emission of light is compared with that of longer electromagnetic waves it is stated: "Because individual atoms are much lighter and less pliable than matter as a whole, they can be the source of oscillating currents of the very high frequency necessary for light and for x rays." Aside from the vagueness of this argument, it gives the reader the mistaken notion that the mass of the atom, rather than the electron, has something to do with the emitted radiation. In a formula showing the transition probability as a sum of the electric and magnetic dipole and the electric quadrupole contributions, all three terms have different dimensions. The equation for the spectral absorption coefficient of a line, which supposedly defines the f value of a transition, does not contain f and the parentheses are missing in the factor $(4\pi)^2$. After being integrated, f appears, but now the atom density is omitted. Finally, there are numerous equations with a differential factor on one side but not the other.

This carelessness pervades the entire volume and it is really a pity because the book is otherwise quite good. It would be worthwhile if the publishers could reissue it with appropriate corrections, but until that is done, I would strongly urge that it not be used as an undergraduate text.

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A senior member of the Lockheed Palo Alto Research Laboratory, the reviewer is the editor of a recent book on radiative properties of very high-temperature air.

Phosphors, elastomers and sealants

MATERIALS OF HIGH VACUUM TECHNOLOGY. VOL. 3: AUXILIARY MATERIALS. By Werner Espe. 530 pp. Pergamon, New York, 1968. $40.00

by LADISLAUS MARTON

Before World War II an excellent book was published by M. Knoll and Werner Espe on the materials of high-vacuum technology. During the intervening 30 years Espe continued to collect material for a substantially expanded version of the earlier book.

In reviewing volume 3 on auxiliary materials, I am amazed by the author's thoroughness in assembling all the information, but at the same time I wonder if all of it is really needed. The topics covered are phosphors, elastomers, sealants, oils and gases with phosphors taking almost half the book! The viewpoint is that of an electron-tube maker, which makes for rather sparse reading for the cryogenicist or someone concerned with, let us say, radiation damage.

At times I became nostalgic in reading parts of the book: It describes the properties and uses of materials that were in use 40–50 years ago and that are known to the present generation only through the songs of Arthur Roberts. I also doubt that anybody interested in high-vacuum technology would use the section on the preparation and fabrication of luminescent materials. Nevertheless the book should be on the reference shelves of the libraries of institutions using high vacuum as a laboratory tool.

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The reviewer is with the office of International Relations at the National Bureau of Standards.

Heat, light and sound

THE PHYSICS OF VIBRATIONS AND WAVES. By H. J. Pain. 241 pp. Wiley, New York, 1969. $5.95

by RICHARD WATERHOUSE

As new and advanced topics are added to science curricula, there is the need for compact and unified treatments of the topics traditionally covered under those monosyllabic but pregnant headings heat, light and sound.

The Physics of Vibrations and Waves had its origin in a lecture course taught by H. J. Pain to new physics and engineering students at the University of London, and contains material from the above three categories, with a good deal of electricity and magnetism thrown in.

Waves and vibrations is one of the new categories now coming into general use, together with statistical physics and quantum physics, and these three categories appear well suited to the realities of modern knowledge.

In nine chapters the book covers

now available

AN INTRODUCTION TO THE MEANING AND STRUCTURE OF PHYSICS

SHORT EDITION

By ***Leon N Cooper, Brown University***

An abridged version of AN INTRODUCTION TO THE MEANING AND STRUCTURE OF PHYSICS is now available. Designed primarily for use in a one-semester course, it may also be used in some two-semester courses. About 200 pages shorter than the original edition, this new version covers nearly all topics treated in the longer work (described below), but simplifies the more difficult parts of the exposition and excludes some of the more complicated concepts and technical illustrations. The perspective, goals, and pattern of the original have been retained. Eighty new problems and eight full-color plates have been added. Answers to selected questions and problems included. Just published. Tentative: 550 pp.; $11.95

THE ORIGINAL EDITION

AN INTRODUCTION TO THE MEANING AND STRUCTURE OF PHYSICS is a beginning text for which calculus is not a prerequisite. Tightly structured, the book examines all the classical topics—mechanics, heat, light, electricity, magnetism—and then studies modern physics. This approach integrates the fundamental ideas of physics within their historical setting; generalizations and abstractions of more advanced concepts follow. The selection of material offers an opportunity to look at physical theories from various points of view: as they are developing; in a classical, formal, or axiomatized stage; and the extent to which they can be developed to provide a picture of the world. Emphasizing concepts, the text studies their development. These concepts are expressed in words; mathematical symbols are associated directly with them. Mathematical tools are introduced in simple, explicit form, as needed, to motivate the use of mathematical ideas as the expression of a concept.

The discussion begins with an examination of the problem of motion and proceeds to investigations of the development of Newtonian mechanics, electromagnetic theory, relativity, Bohr's theory, quantum theory, quantum electrodynamics, and particle physics. While employing elementary techniques, the text presents a unique, detailed treatment of the development of quantum theory. The pace of the book varies; some sections are rigorous and quantitative, others are more expository.

870 illustrations; solved problems; study questions (answers to the odd-numbered ones). 1968. *748 pp.; $13.95*

OTHER HARPER TEXTS OF INTEREST

COLLEGE PHYSICAL SCIENCE, Second Edition / VADEN W. MILES, G. RAY SHERWOOD, and WILLARD H. PARSONS, Wayne State University

For the nonscience major, this text presents fundamentals and recent developments in physics, astronomy, chemistry, and geology. With the treatment of physics as a central framework, the Second Edition features new sections on relativity, semiconductors, thermodynamics, and quasi-stellar sources; emphasis on atomic orbitals, the nuclear atom, and conservation of mass-energy; incorporation of modern techniques (including atomic frequency) in the discussion of time; material on the exploration of the moon; a completely rewritten section on atomic structure and chemical bonding; an introduction of biochemistry as an application of other (chiefly organic) chemistry; and a new chapter on oceans, earth magnetism, and continental drift. 66 new illustrations. Two-Color Format. Revised Instructor's Manual. *1969. 530 pp.; $9.95*

CONCEPTS IN PHYSICAL SCIENCE / SIDNEY ROSEN, University of Illinois, ROBERT SIEGFRIED, The University of Wisconsin, and JOHN M. DENNISON, The University of North Carolina at Chapel Hill

In this text, fundamental, interrelated concepts in the areas of astronomy, physics, chemistry, and geology are approached historically and epistemologically, presenting a unified picture of the physical sciences and showing science as a dynamic human activity and as a constantly changing and growing set of conceptualizations and theories about the value of the universe and its various physical phenomena. Problems and study questions. 380 illustrations. Instructor's Manual. *1965. 577 pp.; $9.95*

THE PHYSICAL SCIENCES: An Introduction / STEPHEN S. WINTER, State University of New York at Buffalo

This brief introduction to the basic ideas of astronomy, geology, chemistry, and physics stresses fundamental conceptual structure, with detailed information serving chiefly to support these concepts. Maintains, wherever possible, the distinction between observation and explanatory theoretical structure. Limits complex illustrations, descriptive detail, and highly technical mathematical treatment. Algebra is used, but not stressed. Study questions and problems; solved problems. 322 illustrations. Instructor's Manual. 1967. 413 pp.; $9.50

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the simple harmonic oscillator, coupled oscillations, waves on strings, transmission lines, electromagnetic waves and Maxwell's equations and diffraction. Two added chapters deal with Fourier methods and nonlinear oscillations. The typical chapter has 15 problems at the end, and Pain correctly describes the complete book as a compact text, as much for working as for reading.

Both the choice of topics and their treatment are commendable. The author manages to cover an immense amount of material with a neatness, economy and style that pleasantly reflect the natural properties of the waves he describes. The mixture of mathematical and physical discussion is judicious, and an occasional vivid remark entertains, as well as instructs, the reader. For example, he mentions that the roar of a large football crowd is just about enough to heat a cup of coffee. Such a remark has also the merit of conveying subliminally to the aspiring scientist the valuable philosophical message that the utilitarian value of hot air is remarkably small.

In addition to the standard material, Pain brings in many interesting topics, including Schrödinger's equation, the tunnel effect, Brownian motion and shock waves, but not lasers. Overall the book is recommended as a most useful addition to the field.

* * *

The reviewer is an associate professor at American University and has been active in the field of waves and vibrations for a generation. He is currently on a sabbatical leave as visiting scholar at the University of California, Berkeley, division of applied mechanics.

Ready-to-wear lectures

OPTICAL INTERACTIONS IN SOLIDS. By Baldassare Di Bartolo. 541 pp. Wiley, New York, 1968. $19.95

by ROBERT SUMMITT

Physicists interested in the optical properties of solids have long suffered the absence of an adequate text, therefore having to make do with superficial monographs, marginally useful conference proceedings and those single-topic reviews that never say quite enough. (It is amazing how thoroughly and how often the cubic lattice is explained.) A forbiddingly wide range of relevant topics has probably been the most important factor in dissuading potential authors, although in recent years we have had such works as Max Garbuny's simpler and unpretentious *Optical Physics* and, of course, J. C. Slater's serial.

Now we have the effort of Baldassare Di Bartolo, a senior scientist of MITHRAS Division of Sanders Associates, who has worked extensively in electronics, microwave engineering and more recently in laser physics. Di Bartolo modestly states that the present work represents "the different subjects . . . that at one time or another have been part of my experience." His experience is impressive.

Di Bartolo says he did not mean to write a text on quantum mechanics or group theory, assuming that the reader has had one-year preparation in the former and none in group theory. The first 11 chapters, nevertheless, present a well detailed and simultaneous development of both subjects and give special attention to the properties of magnetic ions in crystalline environments; the author's objective is to provide a theoretical foundation for lasers and absorption-fluorescence spectroscopy. Using these tools, the last eight chapters treat molecular vibrations, lattice vibrations, various modes of interaction (ion–photon, ion-phonon, and phonon–electron), fluorescence phenomena and laser theory.

I do not think anyone will say the treatment is either superficial or that it is restricted to simple problems. Nor should it be said that Di Bartolo has lost sight of the purpose for a textbook treatment of many related topics, namely presentation in a consistent terminology together with cross referencing of results. In summary, the author's coverage is consistent, coherent and excellent, and the book should serve nicely in a graduate course on the optical properties of solids. It is not quite encyclopedic, however, because not discussed are the classical treatment of lattice-mode polarization waves, specimen boundary-condition effects and scattering theory.

His presentation has a lecture quality, containing many short, one-sentence paragraphs, occasionally even approaching one-equation paragraphs. One suspects that Di Bartolo's econo-