hard enough to manipulate without having to search for its meaning in an elaborate analogy. In brief, the chapter on the First Law answers a question the student does not want asked.

On the other hand, the treatment of reversibility in a subsequent chapter is a gem; and here the book answers questions that the student has asked, and that most texts avoid (as do their instructors). The treatment of the Second Law in later chapters is uneven, in that the virtue of pointing out the fatuousness of several traditional statements about this law is counterbalanced by the contrived treatment of entropy. An unexpected and refreshing aspect is the illustration of the fundamental properties of heat engines in describing a nuclear-power plant; it should help in motivating the student who may wonder whether thermodynamics has anything to do with the real world.

In any event, most teachers of introductory thermodynamics will find here useful approaches and viewpoints for students first meeting high levels of technical abstraction.

The author has striven hard to produce a useful and appealing work. His devotion and his skill are apparent, and instructors will find themselves recommending it to their aspiring students.

DONALD J. MONTGOMERY
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Mathematical Methods In Kinetic Theory

By Carlo Cercignani
227 pp. Plenum, New York, 1969. $15.00

The kinetic theory referred to in the title of this book is restricted to the solution of the Boltzmann equation for inert, monatomic gases under all degrees of rarefaction. This problem has been of interest to aerodynamicists only recently, but is a classical one in physics. Many applied mathematicians and theoretical physicists have contributed greatly to the progress made and Carlo Cercignani is one of them.

Another well known worker in the field, Harold Grad, has said, "In trying to project from the past, we can distinguish three qualitatively different eras: transport coefficients, ad hoc polynomial and moment methods, and the blossoming of more precise mathematical investigations." It is with the last that Cercignani is concerned. As the author says, he is primarily interested in methods not results. Since Kogan's book, *Rarefied Gas Dynamics,* has recently been translated into English and is mostly concerned with results and their application as well as other topics (such as polyatomic gases and mixtures) Cercignani rightly feels that his book and Kogan's are complementary.

A short concluding chapter on results has some very good correlation between theory and experiment, but his book is mostly devoted to the boundary value problems in the Boltzmann equation. He starts with the basic principles of kinetic theory, derives the Boltzmann equation carefully and rigorously, and discusses its basic properties. The linearized collision operator is introduced and studied in detail, and model equations and solutions are given. There is a brief discussion of the Hilbert and Chapman–Enskog theories together with a more extended treatment of the linearized Boltzmann equation. Most of the author's own work is embodied in the treatment of these topics. The book is an excellent summary of recent research in the mathematical theory, and should be of great value to those physicists interested in the mathematical problem.

ROBERT E. STREET
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Elements of Advanced Quantum Theory

By J. M. Ziman
269 pp. Cambridge U. P., New York, 1969. $9.50

Although there are few physics graduate schools where a second year of quantum mechanics is not taught, there is remarkably little consensus about the content of such a course, and very often the personal preferences of the lecturer dominate. In this useful little book, John Ziman states his case in his usual eloquent way. The book's main emphasis is on the methods of nonrelativistic many-body theory, with examples culled principally from the physics of solids. The final two chapters discuss relativistic quantum mechanics and the theory of symmetry operations.

A great deal of physics is crammed into these pages at the expense of most of the intermediate steps in the algebra and a few uncrossed "t's" and undotted "i's". One tends to be referred to "the proper books" when the going gets rough, although there is no bibliography to say which books are proper. The more experienced reader will recognize some of the material and will compliment Ziman on brewing a happy mixture of the difficult parts of his own previous books with the easy parts of some other people's writings. Perhaps the quotation at the start of the book should have been the Bellman's—"I have said it thrice: What I tell you three times is true."

PHILIP L. TAYLOR
Case Western Reserve University

Astrophysics and Stellar Astronomy

By Thomas L. Swihart
229 pp. Wiley, New York, 1969. $9.95

The subject of astrophysics, as the name implies, is based on the methods of physics. Among the branches of physics that are especially useful are those concerned with radiation, and the introductory chapter of this book outlines the basic ideas of radiation. It touches also on nuclear reactions, to the extent that these supply the energy that keeps the stars radiating. In subsequent chapters the author describes the measurement of distance, brightness and motion of ordinary stars and additional information from observation of binary and variable stars.

Up to this point the presentation is intended to furnish the background material for understanding the two major chapters. The first of these is titled "Astrophysics" and deals with several topics. Two sections investigate the physical makeup of stars by comparing them with model stars and adjusting the model parameters so that the calculated brightness, spectra and other properties match those that are observed. As a star uses up its nuclear fuel, it gradually changes its appearance. The section on stellar evolution discusses this "aging" and how it fits into the observed grouping of stars in the Hertzsprung–Russell diagram. Another section deals with various types of interstellar matter and their effect on traversing starlight. The final chapter describes what is known about the structure of our own galaxy as well as others and presents some current ideas on the nature of the universe as a whole.

The book is intended for science majors and is the result of Swihart's teaching the second semester of a general-astronomy course at the University of Arizona. His own research is in radiative transfer in stellar atmospheres.

ROLF LANDSHOFF
Lockheed Palo Alto Research Laboratory

Dispersion Relation Dynamics

By Hugh Burkhardt
289 pp. Interscience, New York, 1969. $18.50

Hugh Burkhardt's intention is to provide "a lowbrow exposition of S-matrix theory." He thus attempts to solve an exceedingly difficult pedagogic problem, that is, to present in a coherent manner a large body of phenomenological material in the absence of applicable physical theory. The problem is analogous to writing an introduction to modern physics without having wave mechanics and the theory of special relativity as *unifying principles.* Within this constraint, he has done quite well.

In two introductory chapters he reviews prerequisite material in complex-function theory, the relevant phenomenology and the mathematical physics of relativistic and nonrelativistic scattering processes. The main section is devoted to a range of standard topics from pion–pion scattering to production-process models. The various topics are treated by first setting the applicable mathematical formalism and then discussing the physical aspects. There are useful discussions of the disagreements with experimental data, and adequate bibliographic selections are conveniently located. The treatment, though compact, is adequate.

The book is somewhat comparable in intent to A. O. Barut's book, *The Theory of the Scattering Matrix* (Macmillan, New York, 1967). Barut gives a more comprehensive picture of the formal mathematical apparatus; Burkhardt emphasizes and attempts to provide a unified view of the essentially heuristic character of the present state of the art.

A. L. HARVEY
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Queens College

Mechanics

By Ray Skinner
744 pp. Blaisdell, Waltham, 1969. $14.50

This book is one of five written by Ray Skinner for a four-semester course for science and engineering students. It is comparable to the *Mechanics* volume of the Berkeley series in the average level of sophistication, but it is far more detailed and starts at a somewhat more elementary level.

I feel very strongly, as Kenneth Ford does (PHYSICS TODAY, January, page 94), that "no textbook can be properly reviewed until it has been used." The following comments are therefore given with some feeling of hesitancy: All one *can do is rely on past experience in* using other standard books.

I think that the book contains too much material. Its 744 pages would create an impossibly heavy burden in a one-semester course. True, there is much material that would generally be covered in "Intermediate Mechanics," and this material could be omitted (there are a couple of impressive flow charts to permit this) but then I question whether the advanced material should have been included. I think that it would tend to frighten and confuse a sizable fraction of the students. It is not sufficient for an instructor to say "We will omit sections X, Y, Z," if these sections make up one-third of the book.

I question also the need for many of the exhaustive details. These struck me most forcibly: the pronunciation of Greek letters, the prefix "atto" (good heavens, another prefix; this one means 10^{-18} something, but, as far as I can tell, it is not used), the unit "Franklin" (Franklin? It is 3.36×10^{-10} C, but who uses it?) and the constant "Dirac" ($\hbar$ in MKS units). This is surely a matter of judgment, but physics has enough complex notations so that one should not stick freshmen with more than is absolutely necessary. And the same goes for units: Although MKS is emphasized, other units, "slugs" included, are used also and certain problems (such as A1.1) require filling in the spaces, to four significant figures, in tables showing the relationships between various units. This sort of thing drives the good students up the wall and into the social sciences and takes too much of the time of the poor ones.

There are many problems and worked examples in each of the chapters, but having most of the problems, as well as the examples, as a part of the running text is distracting. I prefer the conventional approach where the problems all appear at the end of a chapter.

At the same time there are some very good aspects of Skinner's book: the discussions of nongravitational forces, of masses and of motions under central forces appear particularly interesting and clear.

Skinner has painstakingly and carefully written a very complete book that brings in both the mathematical and physical concepts needed for a thorough elementary to intermediate understanding of mechanics. The presentation and the exhaustive coverage lead me, for pedagogical reasons, to recommend it for the faculty and for the library reserve shelf of a tough first-year course rather than for its students.

FAY AJZENBERG-SELOVE
University of Pennsylvania

Elementary Wave Optics

By Robert H. Webb
268 pp. Academic, New York 1969. $11.50

Based on a course taught by the author, Robert H. Webb, this new textbook presents the standard topics of classical physical optics and optical instruments, and introduces the student to modern coherent optics and the mathematical ideas of quantum mechanics. The exposition is unusual in that wave theory is covered in general, in addition to the specialized treatment of optical phenomena.

As expected in a good textbook, many problems of varying difficulty are included with each chapter, and the given solutions extend the material in the text. Detailed solutions to selected problems comprise 20% of the book. The exposition is clear and well illustrated, and the usual brief bibliography and subject index are included.

The text begins with a summary of geometrical optics. A general discussion of wave theory is next, and is followed by treatments of the expected topics of superposition, electromagnetic waves, scattering, polarization, interference and diffraction. The final chapter introduces coherent optics, and various mathematical derivations are relegated to appendixes. Not too large, this book contains sufficient material for a one-semester, intermediate, undergraduate course in optics. It is an attractive additional choice for those instructors teaching such a course who continually search new book lists for a suitable textbook.

RICHARD B. ZIPIN
Bendix Corp

Crystals and Their Structures

By Arthur P. Cracknell
231 pp. Pergamon, Oxford, 1969. Cloth $7.00, paper $5.50

In the preface to his book, Arthur P. Cracknell notes the ever expanding frontiers of knowledge and the consequent changes in courses of instruction at all educational levels. In the belief that the study of crystal structures and some aspects of solid-state physics should be in the curriculum for sixth formers (roughly, equivalent to high-school seniors in the US), Cracknell has written a book that is intended for use as ". . . general background reading for parts of both physics and chemistry courses. . . ." Unfortunately I do not believe the book measures up to the author's aspirations.

In about 200 pages the subject matter ranges over the crystallographic point groups; Bravais lattices; space groups; diffraction of x rays, electrons and neutrons; forces in crystals; wave mechanics; metals, semiconductors and insulators; crystal defects; color symmetry, and group theory. So many topics are covered in a superficial way that the result is often misleading or confusing —when it is not simply incorrect.

I do not intend to document this harsh judgment page by page but will merely cite a couple of irritating examples from chapter 3, "The Internal Structure of Crystals," that are typical of every chapter. On page 85 it is asserted that only Bragg planes with low Miller indices may be densely populated with atoms. Nonsense! Cited as a reference for this chapter is *Theory of*