Momentum Books, an Appropriate Interface

The five books under review here—**Elementary Particles** (153 pp., $1.75), by David H. Frisch and Alan M. Thorndike; **Radio Exploration of the Planetary System** (148 pp., $1.50), by Alex G. Smith and T. D. Carr; **The Discovery of the Electron** (138 pp., $1.50), by David L. Anderson; **Waves and Oscillations** (135 pp., $1.75), by R. A. Waldron; and **Crystals and Light** (160 pp., $1.95), by Elizabeth Wood—are the first of a series, Momentum Books, published for the Commission on College Physics of the American Association of Physics Teachers. The series is published by Van Nostrand (Princeton, N.J.).

Edward U. Condon is general editor; Melba Phillips, William T. Scott, and Jeremy Bernstein serve on the editorial board. In the words of the editor, the aim in publishing the series is to

". . . provide lucid, accurate expositions of important topics in physics, written at a level that is interesting and readily intelligible to students who have had no more than a good introductory course in college physics. Each title in the series focuses attention upon a topic that is either not treated at all, or not treated fully, in such courses. The books ought therefore to be valuable to the better students while they are taking the introductory course, and to students who are majoring in physics, and to the large number of students of other sciences, medicine, and engineering who are interested in a wider knowledge of physics. They ought also to be useful to college and high school instructors as convenient sources of material on special topics."

To review a series of five books, each of 150 pages, is considerably more complicated than reviewing one 750-page book. It would seem most efficient to introduce the books by a brief summary of the contents of each one followed by comments on the text.

Elementary Particles, by David H. Frisch and Alan M. Thorndike, contains ten chapters: "A world unseen"; "Particles we surely need"; "How do we detect elementary particles?"; "Particles we might do without"; "Measuring some of the properties of elementary particles"; "Some elementary particle reactions"; "How the antiproton was discovered"; "Studying the forces between elementary particles"; "Conservation laws and invariance principles"; and "Order out of chaos?"

This is one of several recent books on elementary particles for students beginning their study of physics. It is excellent, thoroughly delightful, yet precise, and an obvious effort has been made to be instructive. An example of this is the exposition explaining the complex idea of parity conservation. The mathematical analysis used throughout is all within the grasp of a student who has completed a good introductory course in physics and the concepts are developed from elementary considerations. The search for the lambda zero particle is described in detail with the result that the reader shares the frustration and the excitement with those conducting the experiment at the Cosmotron. The authors have a sense of humor which is manifest to just the right extent.

Many references of great diversity are provided at the end of each chapter, ranging from the *New Yorker* and *Scientific American* to *The Physical Review* and *Il Nuovo Cimento*. This short book conveys a real sense of the excitement of scientific research, and it should certainly convince the reader that physics is a way of life.

In the second volume, *Radio Exploration of the Planetary System* by Alex G. Smith and Thomas D. Carr, there are seven chapters: "The beginnings of radio astronomy"; "Tools and techniques of the planetary radio astronomer"; "Thermal radiation from the Moon and planets"; "The radio spectrum of Jupiter"; "The origins of planetary radio signals"; "Radar astronomy"; "Radio astronomy and the space age."

In a similar fashion this book fulfills the aim of the series very well. The authors manage to give the sense of discovery—for example, Jansky's measurement of the "cosmic radio noise" and measurement of the local radio source on Jupiter. The book presumes an understanding of the elementary aspects of diffraction, black body radiation, and thermal noise, all at a sufficient level to make meaningful calculations. A few more diagrams would have helped to clarify many discussions such as the one in which the authors describe the temperature of the sun at different levels above its surface. The book concludes with some order-of-magnitude calculations related to the detection of life on other worlds, ending with an invitation to the reader to join the authors in these studies: "Radar astronomy holds forth promise of high adventure. . . " In addition to a general bibliography, each chapter concludes with a list of ten or more references to books and learned journals. The hero of this little book is Jupiter, described somewhat inappropriately by the authors as the "star radio performer. . . ."

The Discovery of the Electron: *The Development of the Atomic Concept of Electricity*, by David L. Anderson, is the third volume in the series. Chapter titles in this volume are "The discovery of the electron"; "The cathode ray"; "X-rays and radioactivity"; "The atomicity of electric charge"; "Later developments in the physics of the electron"; and "The discovery of the electron as a case history in the methods of science."

Anderson prefaces his work with the statement that his book is a "case history," and in the seven pages of the concluding chapter he elaborates very briefly on this point. The book will provide a student with a sense of the number of scientists who participated in refining our present model of the electron and atomic structure. Such books require judicious choice by the author with regard to relative emphasis, recourse to original papers of the scientists involved, and the appropriate amount of analysis and formulae. The interest of the student will certainly depend on these decisions. The major emphasis is given to experiments of Crookes, J.J. Thompson, and, of course, Millikan. There are three pages of numerical data taken from Millikan's book, *The Electron*, and similar data from J.J. Thompson. The model of the spinning electron is inadequately treated in only ten lines. Some excellent points are made by the author, however, in describing the discovery of the positron. As in other parts of the text, a halftone reproduction of Anderson's original plate would have been far preferable to the simple sketch.

The author perhaps has taken too little opportunity to quote directly from the scientists themselves and thus to give the student a sense of more immediate contact. There are only six or seven pages of direct quotation, half of these from Roentgen's well-known paper.

Perhaps the author should have expanded some of his topics that are not usually discussed in introductory physics textbooks— "The pursuit of precision," "Models for the scientific process," "The role of chance," and "The role of local situation."

In this book Anderson provides an excellent review of his subject.

The chapters in *Waves and Oscillations*, by R. A. Waldron, are "Elementary concepts"; "Reflection and refraction"; "Resonance"; "Interference and diffraction"; "Guided waves"; and "Topics in network theory."

Book 4 in the series attempts to consolidate, within 130 pages, a great deal about waves, oscillations, and network theory. If the material is totally unfamiliar to the student, this will not be a convenient book from which to learn it. There is little if any new material, but the author fulfills his declared purpose ". . . to point out the common features of and analogies between waves of different kinds . . ." where, by a wave, the author means ". . . something that can be treated by wave mathematics!"

It is presumed that the reader is acquainted with partial differential equations, and if unfamiliar, the introduction to Fourier series and Fourier transforms will not be appreciated by the student. The emphasis on the use of analogies is worthwhile, but some examples are treated in so cursory a fashion that any real depth of understanding without recourse to well-known texts is unlikely.

Elizabeth Wood sets out to provide an introduction to optical crystallography in the 17 chapters of the fifth volume, *Crystals and Light*: "Symmetry"; "Symmetry in crystals"; "Directions and planes, Miller indices"; "The three-dimensional crystal on two-dimensional paper"; "The thirty-two point groups: Crystal classes"; "The crystalline state"; "The relation between the symmetry of a crystal and the symmetry of its physical properties"; "The velocity of light in cubic and uniaxial crystals: Observation in crossed polarized"; "Uniaxial crystals in convergent polarized light"; "The polarizing microscope"; "The use of accessory plates: Determination of optic sign"; "Refraction of light in crystals"; "Biaxial crystals"; "Dispersion"; "Optical activity"; "Summary of the relation between optical properties and symmetry"; and "Absorption spectra."

Much of this book is concerned with developing the various symmetry properties of crystals, after which the physical properties are examined in relation to the symmetrical structure. The use of light, particularly polarized light for the study of structure is discussed at length, and a piece of Polaroid is included so that students can try the various demonstrations. Problems and questions are available at the end of each chapter, with answers provided one chapter later—a bit like the crossword in the daily newspaper which is resolved in the following issue.

The mathematics required is not difficult, but the subject is. For those who stick with it, they are sure to find this book rewarding, but only the unusual student will exercise this persistence. The author, a well-known crystallographer, has thoughtfully tried to make this subject, which is so meaningful to her, intelligible and exciting, but it is inherently hard going.

The avowed purposes of the Commission on College Physics in promoting this series seems eminently worthwhile. The usual textbook is necessarily confining and the Momentum Book provides an appropriate interface between the introductory text and the papers and treatises to which the more advanced student will turn. One might ask how well these first five books satisfied the criteria of the Commission and the editor? The first three should be distinctly successful. The latter two cover material that is very complex. The volume on waves is an inappropriate choice for the series. It would seem to me that the most successful books will be those in which contemporary physics is developed, by practicing physicists, at a level that can be understood by students in their first years of college physics, complemented by such overall case studies as that of the electron in which the work of many years is condensed into a coherent review. New titles planned for the series include: *Nuclear Models, An Outline of Solid State Physics, Nuclear Spectroscopy*, and *Temperatures, Very High and Very Low*. It would seem wise for the editor to keep in mind the existing books in The Science Study Series, which are available to college and secondary school students, often at considerably lower cost. It will be a challenge to future authors of Momentum Books to meet the criteria stated at the outset—". . . to provide lucid, accurate expositions of important topics in physics written at a level that is interesting and readily intelligible. . . ."

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A First-Rate Collection

Survey of Progress in Chemistry. vol. 1. Arthur F. Scott, Ed. Academic Press, New York, 1963. xii + 340 pp. Illus. $7.95.

This first volume of a new series publication contains seven excellently written articles that cover vastly different fields of chemistry. In the first, R. Schaeffer briefly expands the gamut of research tools now available to the modern chemist in his characterization of chemical compounds. The article stresses the application of nuclear magnetic resonance, mass spectrometry, x-ray diffraction, spectroscopy (ultraviolet, visible, and infrared), and optical rotatory dispersion to problems of chemical interest. Brief illustration is given of electron spin resonance and neutron and electron diffraction. Noteworthy is Schaeffer's diversified interests and experience as a modern inorganic chemist in applying these techniques (with the possible exception of optical rotatory dispersion) to his research investigations of boron compounds (including a single crystal investigation of $B_{10}H_{12}I_2$). Pertinent references are given for those readers who wish to gain further knowledge concerning the theory and use of these tools.

The second article, "High-temperature reactions," by another inorganic-physical chemist, A. W. Searcy, shows the importance of simple thermodynamic relationships in systematically yielding useful and sometimes unexpected information for various types of high-temperature reactions. Searcy first deals with the effect of temperature and entropy on reaction equilibria. He then shows that the behavior of metals at high temperatures depends not only on the properties of the metal but also on those of the nonmetal associated with it. This article is well documented, and detailed examples of thermodynamic applications are given so that the reader is made aware of complications that arise and simplifications that one can make in analyzing and correlating high-temperature reactions. The dangers and common pitfalls in using predictions from thermodynamic generalizations are pointed out.

The third article, "The implications of some recent structures for chemical valence theory" by R. E. Rundle (who recently died), exemplifies Rundle's role as an outstanding structural chemist whose major aims were to relate the