mechanics and the derivation of the wave equation, and on one- and two-electron atoms including a discussion of angular momentum (orbital and spin), the formulation of the Pauli exclusion principle, and a sketch of stationary state perturbation theory. Chapters then follow on the periodic system of the elements and on diatomic molecules.

These introductory chapters are clearly written and quickly accustom the reader to the ways of quantal thinking—the mathematical aspect of the subject is everywhere kept to a minimum and various illuminating qualitative arguments are described. The sections on the wave-particle duality, on electron spin, and on the dependence of the electronic Coulomb energy on the symmetry of the orbital wave function struck the reviewer as particularly lucid. On the other hand, no account is given of the calculation of transition probabilities—time-dependent perturbation theory is not even mentioned while only four pages are devoted to the time-dependent Schrödinger equation. As a result, no treatment of quantum dynamics is really included, the book being essentially on quantum statics only.

The core of Heitler's exposition lies however in the discussion of the elements of quantum chemistry contained in the last third of the book. Here, the ultimately electrostatic forces holding atoms together in a covalently bound molecule are treated from the point of view of the atomic orbital approximation first introduced by Heitler and London. The saturation properties of the covalent bond, the relation of the total spin of the various *L-S* states of the low electronic configurations of an atom to the valency of that atom (with particular reference to carbon), the connection of the spatial character of the electronic wave functions to the bond directional properties, the physical justification of the schematic structural formulae of simple organic compounds (e.g. H—C≡C—H) are all discussed in a masterly, though of course essentially qualitative, fashion. Nevertheless it is a pity that Heitler gives no indication of the power and scope of the rival molecular orbital method in the treatment of covalent bond problems particularly in view of the applicability of this method to the description of the electronic states of macromolecules and solids. Summing up, however, the reviewer can only quote Heitler's last sentence: ". . . it can thus be said that wave mechanics is the tool for a complete understanding, on a physical basis, of all the fundamental facts of chemistry.", and recommend the book strongly to any prospective student of the subject.

Quantum Mechanics (2nd Edition). By F. Mandl. 267 pp. Academic Press Inc., New York, 1957. $6.50. *Reviewed by J. C. Polkinghorne, University of Edinburgh.*

It is not surprising that Dr. Mandl's book first published in 1954 has achieved a second edition. It develops quantum mechanics from the viewpoint of Dirac and von Neumann but its treatment is much more elementary than that contained in the two great classical treatises by those authors. Later in the book the author discusses the applications of group theory to his subject more fully than is usual in elementary texts. Thus we have an introductory textbook presenting its subject with admirable clarity and in such a way that the student is prepared for the more advanced reading that must follow.

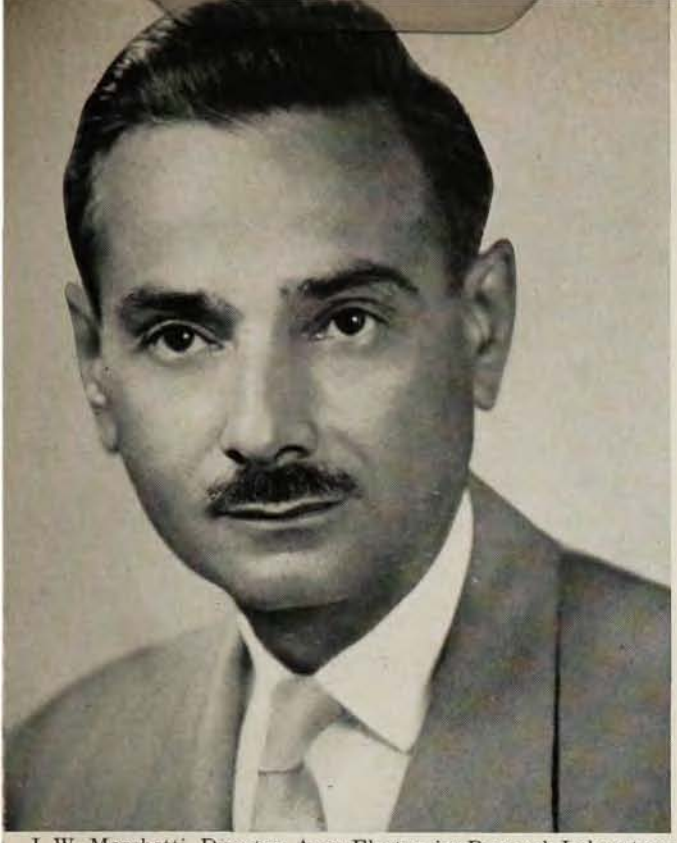
These merits were sufficient to ensure that the book should remain in print for some time. However the first edition omitted some topics which should be contained in a first course. The second edition adds a section discussing partial wave analysis and a chapter giving an elementary description of the Dirac equation, and the result is a good book made better.

Neutron Transport Theory. By B. Davison in collaboration with J. B. Sykes. 450 pp. Oxford U. Press, New York, 1957. $12.00. *Reviewed by E. Richard Cohen, Atomics International.*

The linearized Boltzmann Equation determines the distribution of neutrons in a reactor as well as the transfer of radiation through a stellar atmosphere. In many respects the former application is more difficult than the latter to handle properly, primarily because of the importance of boundary conditions and hence of the non-asymptotic solutions. Yet, in spite of the interest and importance of the field, the literature of neutron transport theory has been meager. Chandrasekhar's *Radiative Transfer* dealt exclusively with the astrophysical aspects and mentioned only in passing that the equations were of importance also in the neutron diffusion problem. Kourganoff's *Basic Methods in Transfer Problems* considered the neutron as well as the photon, but Davison is the first to produce a comprehensive treatise directed exclusively toward the problems of neutron diffusion.

The book establishes the mathematical basis of the neutron transport problem. It is not a treatise on reactors; the physics of neutron diffusion is treated only to the extent required to provide an intelligent basis for the Boltzmann Equation. The major emphasis is on the exact solution of this equation in those instances where this is possible, and the development of approximate methods and series solutions as general methods of attack where exact solution is impossible. *Neutron Transport Theory* is therefore a treatise on the mathematics of the problem rather than the physics of it. From the strictly mathematical viewpoint however, there is a lack of rigor which will bother no one but the mathematician who will himself be capable of supplying the lack. The only serious omission in this regard is the problem of the nonuniform convergence of the spherical harmonic method which has been so thoroughly investigated recently by Kofink (although in honesty to the author it must be admitted that Kofink's work appeared too recently for inclusion).

The comparison between the scope of Davison's *Neutron Transport Theory* and Chandrasekhar's *Radiative Transfer* is interesting and illuminating. Both volumes begin with the same equation and yet there is little du-



J. W. Marchetti, Director, Avco Electronics Research Laboratory

Pictured above is our new Research and Development Center now under construction in Wilmington, Massachusetts. Scheduled for completion in early 1958, this ultramodern laboratory will house the scientific and technical staff of the Avco Research and Advanced Development Division.

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J. W. Marchetti,
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plication beyond the first chapter. The difference lies in the physical problem of particular interest. *Radiative Transfer* is primarily concerned with the conservative (nonabsorbing) medium and attention is focused on the scattering kernel and its possible forms; in *Neutron Transport Theory* the basic scattering process is simple and well defined, the attention here is on the nonconservative case in which the probability of a neutron emerging from a collision may be less, or (in the presence of fissionable material) greater, than unity.

The material in the book is divided into four parts. The first discusses the general formulation of the equations and develops general theorems concerning eigenvalues, eigenfunctions, orthogonality, and completeness. The next three sections concentrate on the important cases of constant cross section, energy dependent diffusion problems with and without spectral regeneration, and the neutron distribution at large distances from the source.

This impressive volume is the first really complete coverage of neutron transport theory to appear. It is surprising that this is so, for almost all of the material has existed in the unpublished literature of the atomic energy programs of the United States, Canada, and the United Kingdom for five to ten years. The commercial prospects of nuclear energy have apparently driven many physicists away from the field. Davison has shown that there is still some physics left in the classical neutron and his book should serve as a needed stimulus to workers in the field by indicating the broad problems and the methods available for their solution, as well as those still unanswered questions which require further investigation.

Basic Physics. Vols. 1 & 2. By Alexander Efron. 692 pp. John F. Rider Publisher, Inc., New York, 1957. $8.95. *Reviewed by Ira M. Freeman, Rutgers University.*

In yielding to the compulsion to include every detailed item that any teacher or supervisor might look for, the authors of many current high-school physics textbooks appear to have lost sight of an important fact: In order to succeed in this highly competitive field, a new book must do more than wedge in a sentence or two about the latest technological achievement. It should offer something novel in method, attitude, or approach.

It was a truly refreshing experience for this reviewer to examine the book written by the chairman of the physics department at Stuyvesant High School, for here we find an original, effective, psychologically sound method of attack—the "spiral approach" to physics. The student is first offered an overview of some of the simpler aspects of physics. Here, in a treatment which is largely descriptive, he gains a perspective of a substantial part of the whole field, at the same time acquiring confidence and losing some of his inborn antipathy to the subject. Then the student returns to a more penetrating and analytical consideration of the material which builds on and enhances the earlier and more descriptive treatment.

The two levels correspond in general to the two volumes into which the work is divided, but short-range "spiraling" is accomplished in adjacent chapters as well. Each volume, complete in itself, cuts across the conventional subject-matter divisions. For example, electrical charge at rest and in motion is treated in Book 1, while circuits, electromagnetic induction, ac theory, and electronics are deferred to Book 2. The treatment of alternating current is admirable and includes the use of the vector representation.

Applications are by no means slighted, but they are presented only after the appropriate principles have been developed. The items are well chosen and include many matters of current interest and importance. Magnetic domains, health physics, cryogenics, ferrites, scintillation counters are all here. And, prophetically, the jacket ornament is none other than "Sputnik" itself!

Other features of the presentation are noteworthy. A generous set of "Questions and Problems" of graduated difficulty follows the text of each chapter. These exercises for the most part are qualitative and descriptive in the earlier sections of the book, more quantitative and analytical in the later portions. The mathematical methods used include algebra, geometry, simple trigonometric functions, logarithms, and the denary notation. Teachers will welcome the numerous suggestions for demonstrations that can be done with modest equipment.

The physical make-up of the book is attractive without being ostentatious. The numerous line cuts are crisp and bold, and halftones of the purely ornamental or "gee-whiz" variety are not in evidence.

Dr. Efron has tested his approach to the teaching of high-school physics for over a decade, and the results have been markedly successful. The spiral seems to carry students to an intermediate level from which at least the better ones will wish to continue work in science. It seems certain that the groundwork laid here will make it significantly easier for both student and teacher in college. The content of *Basic Physics* satisfies the requirements of all College Boards, as well as all local, regional, and state syllabi.

Every teacher and administrator of secondary-school physics would profit by examining and reflecting on this stimulating and soundly conceived textbook.

College Physics. By Robert T. Beyer and A. O. Williams, Jr. 656 pp. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1957. $7.50. *Reviewed by Peter Lindenfeld, Rutgers University.*

What, another book on "College Physics"? Aren't there dozens of these already, all of them teaching Newton's laws, Hooke's law, Ohm's law? Is this another volume stating these and the other rules which when manipulated in the approved way lead to the required answers on examinations? Do we need more books of this sort?