cesses, such as 'breaking the code' of DNA but . . . the basic phenomena of life . . . we still do not understand." Further on, talking about biology he says: " . . . we have hardly scratched the surface of its central problems. . . ."

The very first paper, on electronic structures by J. I. Fernandez-Alonso, is a remarkable summary of methods for computing molecular energy levels and properties. As far as I know it is the only concise description of the various initialled methods such as SCF, MO, LCAO, HLSP, and VB. The 80 pages provide a cursory review of the difficulties attending the approximations of quantum theory in molecular orbitals (MO's). On page 23 it is stated that a diagram of procedure in MO theory is presented "to make it more readily understood by chemists and biologists." A wide variety of biomolecules is described and discussed competently.

The editors have made a broadly representative selection of experimental methods applied to getting information about living systems. These include, for example, electron spin resonance in plants, paramagnetic species in seeds, photo-protection from ultraviolet, nuclear magnetic resonance in specific molecular reactions, infrared spectra of nucleic acids, and thermal effects on proteins, etc.

The format includes heavy paper, large print, good mathematical notation, numerous tables and figures, subject and name indices, and a table of contents. It is a highly commendable, durable, and timely book for students in basic life sciences.

Group Theoretical Concepts and Methods in Elementary Particle Physics. Summer School Lectures (Istanbul, July-Aug. 1962) Feza Gürsey, ed. 425 pp. Gordon & Breach, New York, 1964. Regular edition $19.50; professional edition $12.50.
Reviewed by John G. Taylor, Rutgers University.

Group theory plays a basic role in elementary-particle physics, and there have been important advances very recently, based on certain symmetries which the strongly interacting particles are found to possess. The book under review is a collection of lectures on the various aspects of group theory which are concerned with these and other symmetries of the elementary particles.

Let me first describe the area covered by the lectures. They may be roughly separated into two classes: the first class discussed certain mathematical problems in group theory of physical interest, and the second class discussed more directly physical problems using standard group-theoretic tools. The first class of lectures consisted of a discussion of the Hopf method for the global consideration of compact Lie groups (both classification and representation theory) and some applications (D. Speiser); the local classification and representation of Lie groups (G. Racah); a survey of the inhomogeneous Lorentz group and its unitary representations, including space and time reversal (E. Wigner); group invariance in quantum mechanics and the group extension problem (L. Michel); contraction of Lie groups and their representations (E. Inönu). The second class consisted of derivation of the *PCT* theorem and the relation between spin and statistics (N. Burgoyne); topics in high energy scattering theory (O. Greenberg); the unitary symmetry model, and generalized gauge invariance (S. Glashow); chiral symmetries in strong and weak interactions (Y. Nambu); broken symmetries (A. Salam); introduction to the de Sitter group (F. Gürsey); axiomatization of parastatistics (dell'Antonio, Greenberg, Sudarshan); and a review of the renormalization group (E. Caianello).

The articles vary greatly in length. Taken as a whole they will be of great value to the graduate or other nonexpert student wishing to gain familiarity with the way groups are being used in elementary-particle physics. Most of the articles are readable and have good bibliographies. Further, they cover a broad range. The reviewer thought two of the articles to be too condensed to be really helpful, but eleven out of thirteen is a good percentage. The book contains few minor errors and is very clearly printed. Evidently great care has been taken in publishing. This care may be the reason for the long delay (over two years) between the summer school and the appearance of the book. This delay means that most of the physical lectures of class two have lost some of their topicality or are out of date. Indeed the later successes of SU_3 and SU_6 should have meant much more emphasis on these groups than allowed in a single lecture by Glashow. Even so, the book should be a very valuable introduction to students trying to learn something about groups and elementary particles.

Direct Use of the Sun's Energy. By Farington Daniels. 374 pp. Yale University Press, New Haven, Conn., 1964. Cloth $7.50, paper $2.45.
Reviewed by Robert L. Weber, The Pennsylvania State University.

In this attractively styled book (in sunbeam-yellow binding), Professor Daniels alerts his readers to the rapid depletion of the earth's conventional sources of energy and to the promise that direct use of sunlight holds in supplying the energy of primary importance to man's continued survival on earth.

This felicitous account is popular science at its best. The unsolved problem concerns us all. The account of efforts to solve the problem can be skimmed by a reader chiefly attracted by the historical sketches, illustrations, anecdotes, and foreign ventures. But for the reader who wants to know the cost of solar heat compared with oil heat for a home in Princeton, engineering data are there. And for the serious student who may want to embark on his own research, many tables summarize findings to date, and there is a good bibliography of work in a field in which surprisingly little was published before 1940.

Professor Daniels' humanitarian interest in securing improved water, food, and energy supplies for peoples in areas with very limited resources is apparent throughout this book. So also is the scientist's disciplined imagination and an engineer's willingness to plan beneficial projects feasible with use of local materials.

Solar heating and the distillation of water receive major attention. But there is also discussion of selective radiation surfaces; refrigeration; heat engines; and thermoelectric, thermionic, photovoltaic, and photochemical

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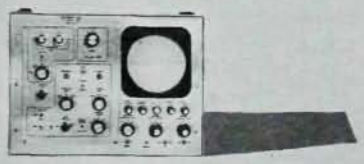

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conversion of energy. Research on the fuel cell is described, but with optimism more restrained than that of Harvard Business School authors who predicted that fuel-cell locomotives will displace Diesel locomotives within eight years.

Physical Electronics. By G. F. Alfrey. 220 pp. Van Nostrand, Princeton, N. J., 1964. $8.50.
Reviewed by L. Marton, National Bureau of Standards.

Reviewing a book is sometimes greatly facilitated by clear and concise statements of the author himself, indicating for whom the book is written and why the book is written. Direct quotations, therefore, are perhaps the best mirror against which to judge the performance of the author. In Dr. Alfrey's book, there are several such clear statements which I would like to quote directly, starting with one from his preface: "This book is an attempt to provide a concise and coherent introduction to the physical principles governing the operation of electronic devices. It is written for electrical engineers and for physicists who are interested in the way the principles of their subject are applied; pressure on the syllabus not uncommonly pushes this aspect beyond the reach of formal instruction." A little further in the preface he outlines two limitations of his book, "The first, relatively trivial, is that many topics of potential interest have to be excluded. . . . The second limitation is more serious. The treatment is largely qualitative and it will no doubt be possible to read the book and yet be defeated by a relatively simple problem, without having acquired that feel for the numerical magnitudes of the quantities concerned which is rightly regarded as an essential part of the scientist's intellectual equipment." At the end of his preface he adds, "I hope that it may continue to serve the reader in his more advanced studies as a kind of guide book relating his work to other aspects of a wide and expanding field."

I would like to add one more quotation from the text. On page 193, the author says, "The book discusses in the main those matters of electrical engineering which follow directly from the physical properties of the electron." In many respects the author succeeds quite well in satisfying his own criteria. The treatment is quite concise, perhaps in some respects too concise to provide the basic training for electrical-engineering and applied-physics undergaduates. I do not know what the differences are between British and American curricula for these types of studies. If I were to teach the subject to electrical-engineering or applied-physics undergraduates, I might want to include a little more detail on many of the physical phases, and then perhaps make the treatment a little more mathematical than descriptive. Also, the definition of physical electronics, in my mind at least, covers more operations involving free electrons than the more solid-state aspects of electronic conduction in solids and in particular, in semiconductors. Chapters 12 and 13, on magnetic properties of matter and on dielectric materials, may be definitely excluded from the way I view physical electronics. The other chapters, which I would maintain are, Electrons in Atoms, Forces between Atoms, Emission of Electrons from Solids, Electron Optics, The Control of Electron Current in a Vacuum, Electrical Conduction in Gases, Gaseous Plasma, Electrical Noise, and Molecular Amplification.

The author starts out with a definition of the scope of electronics which I rather like because it is old-fashioned and it is in definite disagreement with the application of the word "electronics" to all kinds of high-frequency phenomena. The style of the book is extremely readable, in many places even almost florid—for instance, when he calls a process of measurement "intolerably clumsy" (page 63) or the first attempts toward advanced theory of solids, "heroism pushed to the extremes of folly" (page 119). There are places where I would be inclined to disagree with the author: for instance, at the beginning of Chapter 8 where he apologizes for including in his book a discussion of gaseous plasma, saying that gaseous plasma is an unfamiliar state under normal terrestrial conditions but is widespread in nature once one moves away from the earth's surface. I don't believe any apology is needed. I am inclined to disagree also with a certain number of historical statements, such as, on page 18, where according to the author, "The nature of the rays was a matter of widespread speculation, but the only tangible idea that was put forward was a suggestion that the rays consisted of charged particles." The author is talking here about the nature of cathode rays and their interpretation during the second half of the last century and neglects to mention that for several decades there was a marked controversy between British and German physicists. The British represented the corpuscular idea whereas the Germans were definitely in favor of the wave concept.

There are a few minor items which I would have preferred not to discuss. I would say that there is a definite lack of good proofreading in the book. The number of misprints is far from negligible. Not many of them mar the text, but if the name of Mosotti is consistently spelled Misotti, it indicates a little deeper defect than just bad proofreading.

In spite of the minor defects, I do recommend the book as a good concise introduction into the subject of physical electronics.

Moderne Probleme der Metallphysik. A. Seeger, ed. Vol. 1, Fehlstellen, Plastizität, Strahlenschädigung und Elektronen-Theorie. 445 pp. Springer-Verlag, Berlin and New York, 1965. $14.75.
Reviewed by Walter G. Mayer, Georgetown University.

Some time ago a meeting held in Stuttgart was concerned with modern topics of metal physics related to solid-state physics. The authors, most of whom are with the Technische Hochschule or the Max-Planck-Institut in Stuttgart, have rewritten and considerably enlarged their papers given during that meeting and have collected them in two volumes.

As the title indicates, the first volume deals with imperfections, plasticity, radiation damage, and electron theory of metals. Although it is assumed that the reader has a certain amount of general background information, the authors make an effort