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

to discuss general ideas before dealing with more sophisticated aspects of their topics. The first chapter (E. Kröner) gives a review of dislocations and a résumé of an approximation approach to the continuum theory. The third chapter (H. Kronmüller) presents a very extensive treatment of the theory of plastic deformation, preceded by an experimentally oriented chapter (R. Berner and H. Kronmüller) on plastic deformation of single crystals, particularly fcc and hexagonal metals. This well-illustrated section can be considered a continuation of the chapter on crystal plasticity in volume VII/2 of the *Handbuch*. The fourth chapter (S. Mader) discusses interesting aspects of electron-microscopy techniques for the investigation of dislocations, and the fifth (J. Diehl) concentrates on a discussion of imperfections and radiation damage. Here, as well as in the last section (H. Bross), on electron theory of metals, one finds good balance between introductory subjects and less known, sometimes new material.

Interesting features of the book are that it contains a relatively large number of unpublished results and that the authors are not afraid to discuss problems still in the speculative stage. The healthy mixture of well-established and new ideas, together with an extensive bibliography, makes this volume a fine reference book and a guide for future research in metal physics.

Structure of Matter. By Wolfgang Finkelnburg. 511 pp. (Springer-Verlag, Berlin) Academic, New York, 1964. $14.50.
Reviewed by William F. Meggers, National Bureau of Standards.

First published in 1948 under the title *Einführung in die Atomphysik*, the book by Wolfgang Finkelnburg has undergone numerous revisions and printings in three languages. This English version, excepting the title, is almost a verbatim translation of the 9th/10th German edition, also printed in 1964. Incidentally, both books are octavo, 10 point, but the 552 pages of the German printing are reduced to 511 in English!

"This book deals comprehensively with our present-day knowledge of the structure of matter from elementary particles to solids. It has been written for students of physics, chemistry, biology, and engineering." (Preface.) It contains seven chapters: Introduction; Atoms, Ions, Electrons, Atomic Nuclei, Photons; Atomic Spectra and Atomic Structure; Quantum Mechanics; Physics of Atomic Nuclei and Elementary Particles; Molecular Physics; Solid-State Physics from the Atomistic Point of View; and a subject index. The chapters end with lists of pertinent literature, exclusively books (encyclopedias, treatises, text books, monographs, etc.), no periodical papers. Apropos, the only sins of commission or omission found so far are on page 147 where three volumes of *Atomic Energy Levels* by C. E. Moore, listed in the German printing, are reduced to two in this English translation, and on page 210 where the two-volume treatise on *Quantum Theory of Atomic Structure* by J. C. Slater (McGraw-Hill, 1960) is omitted. For the first time, four to eleven perplexing problems (without answers) have been added to each chapter of this English edition which will surely make it more challenging and interesting to students and teachers.

Structure of Matter presents in relatively small space a surprising survey of apparatus, experiments, observations, measurements, theories, models, quantum interpretation of spectra, wave-mechanical treatment of atomic systems, radioactivity, elementary particles, atoms, ions, molecules, crystals, nuclear bombs, and reactors, even including such esoteric subjects as acausality, complementarity, indeterminacy, magic numbers, and philosophical reflections. No doubt some physicists will find the quantum-mechanics chapter inadequate; some chemists will point out that there are thousands of times as many kinds of molecules as of atoms, and some mechanical engineers may not appreciate quantum mechanics. The only reference to biology is via DNA molecules. "The author's aim has been to provide the reader with the grounding essential to a true understanding of this vast sphere of science which during the past few decades has led to so great a change of our fundamental concepts of nature and which