ters has been improved and rearranged slightly to form the first 20 chapters of the 24 of this edition. One major change is that the subject of rotations and other symmetry operations is now in the 16th instead of the final chapter. This is an improvement because it allows the perturbation methods that follow to be applied to a wider, more representative set of problems.

Another change is the insertion of a brief chapter entitled "Dynamics of Two-Level Systems" in which the author uses this simple example to discuss the density-matrix description of ensembles and the conventional "reduction of the wave packet" view of measurement theory. Anyone contemplating the adoption of this book as a text for his course might do well to study this brief chapter of 18 pages, because it reveals the strengths and weaknesses of the author's approach. New ideas are exposed via very simple mathematics and thus presented in a simple way. One may complain that the generality and revolutionary implications of these ideas are neglected. The timid mind will not be frightened, but the adventurous one will not be greatly stimulated.

In the final four chapters the idea of second quantization is introduced and applied to the electromagnetic field and to electrons. The development begins by postulating that the eigenstates of the occupation-number operators form a complete set. In the final chapter the one-electron Dirac field is recovered from the many-particle theory, and applications are discussed. Not having tried this approach in the classroom, I have no informed opinion of its value. It is certainly true that students find the historical approach of quantizing the modes of the classical field difficult. The density of new ideas in these final pages would, I think, not allow their use as standard text material, but the more enterprising students may enjoy seeing a preview of these advanced topics.

This book has been improved in thoughtful and careful ways, but it is not greatly changed.

Gordon Lasher
IBM T. J. Watson Research Center

Cosmic Electrodynamics

By J. H. Piddington
305 pp. Interscience, New York, 1969. $18.50

In his preface J. H. Piddington suggests that "a monograph dealing with such a fast developing subject tends to grow out of date." He then continues with the somewhat contradictory remark: "However, a large part of the material has now settled into permanent form, ..." Despite the doubts expressed by the first statement and the possibility of considerable disagreement as to how

much has actually settled into final form, the book is a useful review of the current state of the art and contains an appropriate supporting bibliography. The word "art" is used deliberately. As Piddington correctly notes, many of the problems currently under examination are being investigated by a judicious combination of firmly established theory, physical intuition and suitable approximations. And there is, of course, a paucity of experimental data.

Piddington has contributed actively to many of the areas treated, and this is apparent in the concise yet clear manner in which he has reduced a large bulk of material to sensible proportions.

The principal merit of the book is that it provides a ready orientation in the various topics subsumed by the title. All a potential reader requires is a reasonable background in electromagnetic theory at the graduate level. The book provides a kind of précis indicating methods; it states general results and provides a supporting bibliography. It should be clearly understood that the book is not intended as a test for either class room work or for self-improvement. For instance, its 16-page chapter on "Principles of Cosmic Electrodynamics" is certainly not intended to compete with any of the presently available 400–500-page texts on the electrodynamics of plasmas. It is an introduction and guide to a number of related research areas. The detailed study must be based on other text and literature materials.

Three introductory chapters outline the basic results from theoretical magnetohydrodynamics, their application to plasma physics and their utilization in the treatment in a general way of the specific problems to be encountered. There then follows discussion of the electrodynamic aspects of solar activity, the solar-planetary interspace, the planetary fields and radiation belts, and, finally, galactic dynamics, radio galaxies and the array of quasars and other mystifying cosmic objects.

The book has a stated point of view. It is concerned primarily with the magnetic field in determining the structure of the phenomena discussed. This leads to a treatment of such topics as galactic dynamics and other cosmic phenomena that is somewhat one-sided. The uninitiated reader should be aware of these matters and the currently wide diversity of opinions among experts.

A book that deals with a particular aspect of largely unsolved problems will not only present, as indicated, a single point of view; it will be necessarily quite subjective as to choice and weight of material. Universal agreement as to the topics to be included, the extensiveness of the treatment and the choice of bibliographic support is not to be expected. These are all constraints to be understood rather than bases for objections. Piddington has made a useful and successful effort.

Alexander Harvey
Queens College, New York

Electronic Principles: Physics, Models, and Circuits

By P. E. Gray, C. L. Searle
1016 pp. Wiley, New York, 1969. $15.95

The prominent feature of this book is that, in accordance with the present trend in the development of electronics, the whole exposition is based on semiconductors rather than on vacuum tubes, the description of the operation and uses of the latter being deferred to appendices. It was found convenient to introduce the behavior of semiconductors by means of the qualitative valence-bond model rather than through wave mechanics and the band-energy model. This approach is satisfactory, from the electronic-engineering point of view, in providing a quantitative presentation of semiconductor junctions. No quantitative background in quantum theory is thus required. "The book begins with the physical principles that are involved in the operation of semiconductor components, proceeds through the physical electronics, modeling and circuit characteristics of these components, and engages the questions and problems that arise in the computer-aided design of complex multistage amplifiers and functional assemblies of the type found in modern integrated-circuit packages." The text, based on courses taught at Massachusetts Institute of Technology, is very carefully presented, with numerous worked-out examples and problems and with suggestions for demonstrations. It is so well framed that it appears to be suitable even for self-study.

J. E. Romain
Court St. Etienne, Belgium

Physics of Sound in the Sea

By Lyman Spitzer, Jr, P. G. Bergman, A. Yaspan, E. Gerjuoy, J. K. Major, R. Wildt
566 pp. NAVMAT P-9675, US Government Printing Office, Washington, D. C., 1969. $7.00

Oceanography, although a recognized discipline in the 1930's, underwent a rapid acceleration in the 1950's and 60's to take its place today as one of the most talked-about fields of scientific endeavor. Much of the initial impetus for this burst was derived from the close wartime association between the oceanographers of the Woods Hole and Scripps Institutions of Oceanography and the physicists who came from their many laboratories to join the Columbia University and University of California underwater-sound research group