not correct that ". . . negative numbers are invariably stored in complement form" (p. 44). One chapter on coding attempts to justify the use of interpolation techniques in the evaluation of basic functions, although this method is not adequately compared with others that are more widely used. A statement that will provoke considerable argument is made on page 169, where the authors declare that floating-point subroutines ". . . should be regarded as a last resort rather than as an easy alternative to careful planning."

In short, although this book probably covers the field better than any existing volume, it can be recommended as a textbook only if it is to be supplemented and corrected by someone who is well acquainted with the art of automatic computing.

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Microwave Spectroscopy. M. W. P. Strandberg. Wiley, New York; Methuen, London, 1954. vi + 140 pp. Illus. + plates. $2.50.

Microwave spectroscopy had its origin about 20 years ago, but its major progress has been made in the last 8 or 9 years. Along with its rapid growth, an extensive literature has appeared in periodicals. However, this volume, so far as I know, is one of two books (my review of the other appears in the next column) written on the subject

Microwave Spectroscopy by Strandberg deals, in the words of the author,

> . . . with a calculation of the quantum energy levels of a rotating molecule, and considers the various perturbations which may or must be recognized to interpret precise experimental data. The final sections deal with the instrumentation necessary to measure the frequencies in the microwave region which are characteristic of differences between these energy levels.

The book is tersely written; to read it with understanding requires an extensive background in the matrix formulation of quantum mechanics and a considerable capability in mathematics—that is, the use of tensors in the chapter on nuclear quadrupole energy. The chapters on experimental considerations are likewise compact and assume familiarity with microwave techniques. A brief bibliography and three appendixes conclude the book. Appendixes I and II are tables of reduced energy and line strengths, respectively. Appendix III gives rotational magnetic moment matrix elements on the space-fixed Z(M) axis.

It seems to me that there might be many readers surveying this important field who would be discouraged from completing a study of this book because of the condensed manner in which it is presented. But Strandberg makes no particular claim that this is the group to whom he is appealing. There is no doubt that anyone who desires to do research in the field of microwave spectroscopy must master the theory outlined in this scholarly work.

Microwave Spectroscopy. Walter Gordy, William V. Smith, and Ralph F. Trambarulo. Wiley, New York; Chapman & Hall, London, 1953. xii + 446 pp. Illus. $8.

The preface of this book states that the understanding of microwave spectroscopy requires knowledge of several branches of theoretical physics, chemistry, electronic circuitry, and microwave components. The aim of the book is to provide a convenient source of information on the significant spectroscopic components and a survey of the theory fundamental to understanding this important field. This aim, in my estimation, is successfully accomplished. The contents include information on instruments and experimental methods, microwave spectra of gases, solids, and liquids, the Stark and Zeeman effects, molecular structures, and a variety of other topics. Numerous photographs, charts, graphs, and circuit diagrams enhance the value of the book.

This book was not written primarily as a textbook, but because of the clarity and detail with which much of the material is presented, it might be useful as such.

There is a long list of pertinent references at the end of each chapter, and the book closes with a chronologically arranged bibliography of important published papers on the applications of microwave spectroscopy to gases, paramagnetic resonance of solids and liquids, and ferromagnetic resonance. This should be of great value to anyone who has to search the literature for specific information. The appendix contains an extensive tabulation of data useful to the worker in this field. This volume should be of considerable value to students and research workers in this field.

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The Metabolism of Algae. G. E. Fogg. Methuen, London; Wiley, New York, 1953. ix + 149 pp. Illus. $2.

This brief book attempts to cover the biochemistry of a very large group of diverse plants, ranging from unicellular forms closely related to bacteria to the seaweeds of commercial importance. It is evident that the available knowledge varies widely from one organism to another. Certain unicellular species that for technical reasons are suitable for studies of photosynthesis are well known from the point of view of intermediary metabolism. In contrast, the seaweeds have been of interest primarily from the point of view of the end-products of metabolism, such as the polysaccharides.

Chapters are devoted to the photosynthetic and

chemosynthetic assimilation of carbon and to autotrophic and heterotrophic assimilation of nutrients. Also considered are the end-products of metabolism and various aspects of growth.

Because of the very broad field covered in a limited space, this book is not an intensive monograph and has little to offer the specialist. To students and research workers who desire a brief survey of the biochemical literature of this heterogeneous group of plants, this book will offer much information of interest. The bibliography of some 300 items and the index add to the value of the book. It is well worth the price asked.

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Introduction to Tensors, Spinors, and Relativistic Wave-Equations (Relation Structure). E. M. Corson. Hafner, New York, 1953. xii + 221 pp. $10.

The phrase *relation structure* in the title is important to an understanding of the content of this valuable book and of the point of view from which it is written. The existence of half-integral spin fields in the description of the elementary particles is very deeply connected with the existence of an essentially two-valued representation of the basic group of physics. This purely mathematical fact that the proper (homogeneous) Lorentz group is rightly regarded as one of many homomorphic images of the more fundamental spin representation group leads to an extensive and intricate set of interrelationships among various transformation groups, their infinitesimal generators, and the spaces on which they operate. It is with these structural relationships that the author is concerned, and they give his book a permanence of value it could not otherwise achieve in view of the somewhat chaotic and incomplete state of the physical theory expounded.

The first two chapters form part I, "Mathematical introduction," and establish the basic mathematical framework of the tensor and spinor analysis, respectively. The selection of material here is explained in the preface:

> Our presentation is based on the view that the theoretical physicist is primarily interested in the intelligent application of the rules of the spinor calculus, rather than in the more abstruse geometrical theory of the pure mathematician (which is not intended to detract from the necessity and beauty of the latter development).

The result of this policy decision is that the spinor formalism is developed mercilessly and is used with casual ease. Since there is every indication that the author himself has understood the underlying geometry (not so abstruse, really), the loss of clarity is not as great as might be expected from dependence on the massive notational framework with its multiplicity of indices. (The only extended treatment of this geometry in the formalism of the present volume known to me is in the 1935–36 notes on lectures by O. Veblen and myself entitled "Geometry of complex domains." These have been long out of print and unavailable but are now being reprinted at The Institute for Advanced Study, Princeton, N.J.).

The second part, "Physical principles," treats the general field theory and relativistic wave-equations in their field and matrix-algebraic aspects. Beginning with a Lagrangian density, the variation principle is used to derive field equations. Other topics in Chapter 3 include conservation theorems, gauge invariance, interaction of electromagnetic and matter fields, and canonical Hamiltonian formulation of the field theory.

The Dirac-Fierz-Pauli theory is given major attention in Chapter 4, but the Chandra and Proca contributions are also considered, the 4-spinor formulation is developed, and there is a concluding section on spin and statistics.

The final and longest chapter (66 pp.) reconsiders and systematizes the theory from the point of view of the representations of the homogeneous and inhomogeneous Lorentz groups, as developed by Wigner, Bargmann, Gelfand, Neumark, and others. Here the powerful concepts of the structure of algebras are used to establish the essential identity of apparently different wave-equations.

The book is rich in its detail, is literate in style, and contains a valuable bibliography and index. The printing was done by Blackie and Son in Glasgow and fully sustains the high reputation of that firm. While the book is certainly very difficult to read, and a small part of this should be charged to the author, the contribution it makes to the foundations of theoretical physics is considerable.

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An Illustrated Catalogue of the Rothschild Collection of Fleas (Siphonaptera) ***in the British Museum,*** vol. I. ***Tungidae and Pulicidae.*** G. H. E. Hopkins and Miriam Rothschild. British Museum (Natural History), London, 1953. 361 pp. Illus. + plates. £4 4s.

G. H. E. Hopkins, assistant to Karl Jordan at Tring and recently retired from the British African Service as a medical entomologist, is a top authority on world fleas. Miriam Rothschild, daughter of the late N. C. Rothschild, founder, one might say, of world siphonaptery, is a specialist in bird fleas and underwriter of the cost of this elaborate catalogue.

The unexcelled art work is made up of line drawings, many comparative, mostly from the pen of Jordan's young assistant, F. G. A. M. Smit, who is an artist in his own right and an enthusiaste student of world fleas. Some are from the originals or are a modification of them. The photomicrographs, which make