purpose of elucidating the prospects of interstellar communication, or the scope of unusual information on very different topics, not so often found in one volume. Most of the articles are written on a popular level; others are more technical, but their meaning should be accessible to the intelligent reader.

Astrophysical Quantities (2nd ed.). By C. W. Allen. 291 pp. Athlone, London, 1963. Distr. in US by Oxford Univ. Press, New York. $10.10.
Reviewed by ***Martin F. McCarthy, S.J.****, Vatican Observatory, Castel Gandolfo, Italy.*

To publish a book of precise values for astrophysical quantities at this point in the evolution of modern astronomy demands both courage and competence. The first edition, published in 1955, demonstrated the author's courage in facing the challenges offered by unprecedented advances in astrophysics during the first five decades of the 20th century. It also showed his exceptional competence in searching out the most reliable values from the voluminous literature and in presenting these with fairness, balance, and a fine sense of order. The fact that he is called upon again within eight years to publish a second edition indicates the fast pace of astrophysical research. Professor Allen deserves the thanks of his colleagues.

The aim and form remain the same: to present in numerical and tabular form the essential quantitative information on astrophysics. The increase in size has been limited very prudently to 28 pages. The chapters which present the constants of physics remain approximately the same length as before, while the sections devoted to the earth, planets, and satellites; and to the sun, stars, and stellar systems have been amplified. The sections on stellar populations, open clusters and associations, and sources of radio emission reflect very well the new advances made since the last edition. The author has resisted the temptation to include data on space flights and artificial satellites. Special praise is due for the description and use throughout the book of the new system of galactic coordinates.

Readers should start at the very beginning and examine the author's excellent introduction in which he acknowledges how very changeable constants can be and stresses the importance of understanding the qualifications required in such a compilation. These include ready availability of data, avoidance of ambiguity, conciseness, generality and completeness, accuracy, and evaluation of errors. The principal danger associated with a book such as the present one is that the readers will accept the published values too uncritically in spite of continued warnings. This danger may perhaps be less for the observational astrophysicist than for the theoretician. As an instance of this consider the following example. Since the completion of this edition in November 1962, the accepted value for the distance from the sun to the center of the galaxy has been revised upwards from 8.2 to 10.0 kiloparsecs and the velocity of rotation in the solar neighborhood changed from 215 to 250 km/sec. No author can be expected to issue weekly supplements to his work. Rather one must expect that with the author's precautions in mind, his readers will employ the valuable data compiled here with care but without a blind and absolute acceptance.

The references are exact, concise, and a clear guide to the literature. A "must" for every library, this excellent book merits a place on the desk of every astronomer.

Matrices and Tensors. By G. G. Hall. Vol. 4 of Topic 1 of The International Encyclopedia Of Physical Chemistry And Chemical Physics, edited by E. A. Guggenheim, J. E. Mayer, and F. C. Tompkins. 106 pp. (Pergamon, Oxford) Macmillan, New York, 1963. $6.50.
Reviewed by ***J. Gillis****, Weizman Institute of Science, Rehovoth, Israel.*

The development of high-speed computing machines has stimulated a growth of interest in linear algebra, and a large number of books on the subject have appeared in recent years. However, most of these have been addressed to the professional computer specialist or mathematician and are too detailed to be useful to chemists. In the circumstances there was room for a book like the present one which concentrates on a lucid and concise presentation of the topics most likely to occur in physico-chemical research.

Of Interest to Physicists and Engineers

RELATIVISTIC QUANTUM MECHANICS

By JAMES BJORKEN and SIDNEY DRELL, both of Stanford University. *International Series in Pure and Applied Physics.* Off Press.

The first of an important two-volume graduate level work for experimentalists and theoreticians. Covers the contemporary topics as well as most recent advances in this rapidly changing field including quantum electrodynamics, Feynman calculations, S-matrix techniques and other field-theoretical techniques in high energy nuclear physics.

INTRODUCTION TO PLASMA PHYSICS

By MARTIN A. UMAN, University of Arizona. Off Press.

Designed for a one semester course, this text introduces the student to the physical and mathematical concepts fundamental to all branches of plasma physics and engineering. It can be understood by average engineering students who do not have a strong background in physics. The material is presented in a new logical manner. Problems form an important part of the text.

CONCEPTS OF MODERN PHYSICS

By ARTHUR BEISER, Columbia University. 357 pages, $7.95.

An up-to-date work distinguished by its well-integrated, unusually logical progression from relativity and quantum theory through the atom, molecule, and nucleus. The book is divided into four parts: Basic Concepts, The Theory of the Atom, Properties of Matter, and The Nucleus. Designed for sophomore or junior year students majoring in engineering or one of the physical sciences, who have completed elementary courses in physics, chemistry, and calculus.

VECTOR MECHANICS, *Second Edition*

By DAN EDWIN CHRISTIE, Bowdoin College. 622 pages, $10.75.

Using the language of vector algebra and vector calculus, this self-contained text for sophomore-junior physicists and engineers presents systematically the elements of mechanics. Vectors are used in ample detail. Concepts of mechanics are introduced gradually, with dimensional analysis as a guide. Topics have been reordered and a chapter on Introduction to Methods of Lagrange and Hamilton has been added.

FUNDAMENTALS OF ELECTRICITY AND MAGNETISM

By ARTHUR F. KIP, University of California, Berkeley. *McGraw-Hill Series in Fundamentals of Physics.* 432 pages, $8.50.

Relates the basic laws and concepts to experimental results. Displays, on the theoretical side, the remarkable economy of description of the basic phenomena of electromagnetism made possible by Maxwell's equations. Practical examples of the operations of the laws are discussed when they help to clarify basic principles.

GROUP THEORY AND QUANTUM MECHANICS

By MICHAEL TINKHAM, University of California, Berkeley. *International Series in Pure and Applied Physics.* 340 pages, $11.50.

This new volume presents the elements of group theory most pertinent to physical applications and provides a brief but systematic analysis of the quantum mechanics of atoms, molecules, and solids, emphasizing the use of group theoretical techniques. Features: a lucid presentation of the calculation of energy levels and selection rules . . . a treatment of the magnetic groups with illustrative applications to real magnetic systems . . . exercises follow each chapter.

FUNDAMENTALS OF MICROWAVE TUBES

By MARVIN CHODOROW, Stanford University; and CHARLES SUSSKIND, University of California at Berkeley. *International Series in Pure and Applied Physics available in May.*

Designed for graduate students in physics and electronic engineering and workers in the microwave field, this new text evolved from a series of courses given at the Microwave Laboratory at Stanford University. The text is general in scope, with an emphasis on fundamentals.

INTRODUCTION TO THE QUANTUM THEORY

By DAVID PARK, Williams College. Available in April.

A new textbook on quantum mechanics designed for use in advanced undergraduate or beginning graduate courses. The first half develops the general formalism of the quantum theory; the second part gives extensive applications to atomic and nuclear and solid state theory and to statistical mechanics. A course on the fundamentals of atomic physics is a prerequisite.

Examination copies available on request

McGRAW-HILL *Book Company*

330 West 42nd Street, New York, N.Y. 10036

There are chapters on vectors, matrices, linear equations, eigenvalues and eigenvectors, and tensor algebra. If the work should run to further editions, one would welcome the addition of a section on relaxation procedures, at least sufficient to enable the research worker or student to know where to look for more detailed accounts and what to seek in them.

Foresight and Understanding. An Enquiry into the Aims of Science. By Stephen Toulmin. 115 pp. Harper & Row, New York, 1961. Paper $1.15.
Reviewed by ***R. B. Lindsay,*** *Brown University.*

The scientific method, when looked at critically, is susceptible of many interpretations, and this makes the philosophy of science a subject of never-ending fascination and a copious source of literature. The volume under review, whose author is a well-known philosopher and historian of science, originated in the thirty-fourth series of Mahlon Powell lectures at Indiana University in 1960. The aim of the book is to consider the central question: what makes a scientific theory, idea, or investigator successful?—in short, what is the meaning of success in science? This program is carried out in three phases: (1) the demolishing of the view that the purpose of science can be epitomized in a single phrase, (2) stress on the importance of "ideals of natural order" in the development of scientific explanation, and (3) introduction of the biological analogy of "survival value" as a test of the worth of a scientific idea.

The plan is attractive and the author's development of it is learned, vigorous, and persuasive. His style is pleasant and his illustrations appealing. If he fails to convince in every respect, it is partly because the magnitude of the task far outruns the space at his disposal. Yet his judgments throughout are highly suggestive and bear close examination. In his first phase, he attacks specifically the rather widely held pragmatic view that the principal purpose of science is to predict experience, and that our confidence in it as a worthwhile activity rests on the success with which it carries out this purpose. He then proceeds to note that different ages inevitably develop different views as to what concepts or "ideals of natural order", as he calls them, are genuinely fruitful; several plausible illustrations are presented from the history of physics and chemistry. Finally, the author draws an analogy between the evolution of scientific theories and biological evolution: scientific ideas survive by a kind of natural selection.

All this makes interesting and suggestive reading. But it leaves many questions open. In the last analysis, a scientific theory is really only a way of talking about a part of our experience, of such a character that it makes us feel we understand it; and if history teaches us anything definite about this, it is that it is a rather arbitrary process in which preference and taste enter decisively. The author's examples illustrate this very well, but emphasis on the point itself seems to be lacking. The same is true of the closely related problem of the extent to which scientific explanation is invention rather than discovery.

But, cavils aside, this is a very stimulating book and should be read by all physicists who have any interest in the foundations of their science.

Entropy. The Significance of the Concept of Entropy and Its Applications in Science and Technology (2nd ed.) By J. D. Fast. 313 pp. McGraw-Hill Book Co., Inc., New York, 1962. $10.75.
Reviewed by ***Joseph G. Hoffman,*** *State University of New York at Buffalo.*

The broad title, *Entropy,* may be misleading because this book deals with what might be called, for lack of better terminology, ideal entropy. The preface points out that there is no reference to the thermodynamics of irreversible processes and the accompanying production of entropy, or to the entropy concept in information theory. Therefore, since there are many new and interesting developments in these latter fields, it is desirable to specify the approach to entropy taken.

It deals primarily with the ideal entropy of reversible systems in equilibrium states. The first chapter describes the entropy concept in classical thermodynamics. Chapter 2 presents essentially statistical definitions. Here, the quantum state is introduced and examples discussed such as the specific