experimental as well as theoretical developments may bring to it.

In summary the main difference between the book published in America and the one from Germany is that whereas the one, in the context of current research, raises ideas to debate, the second one, in the historical aftermath, lays them to rest.

* * *

Daniel C. Mattis is on the staff of Yeshiva University and is visiting professor at Yale University. He is the author of The Theory of Magnetism: an Introduction to the Study of Coöperative Phenomena *and other works.*

Popular crystallography

ORDER AND DISORDER IN THE WORLD OF ATOMS. By A. I. Kitaigorodskiy. 135 pp. Trans. from Russian. Springer-Verlag, New York, 1967. Paper $2.80

by Lawrence Sklar

This brief, profusely illustrated paperback is Volume 3 of Springer-Verlag's series, "The Heidelberg Science Library." Completely nonmathematical and nontechnical, the book is a popular exposition of a number of topics in the theory of matter and is easily accessible to any interested lay reader.

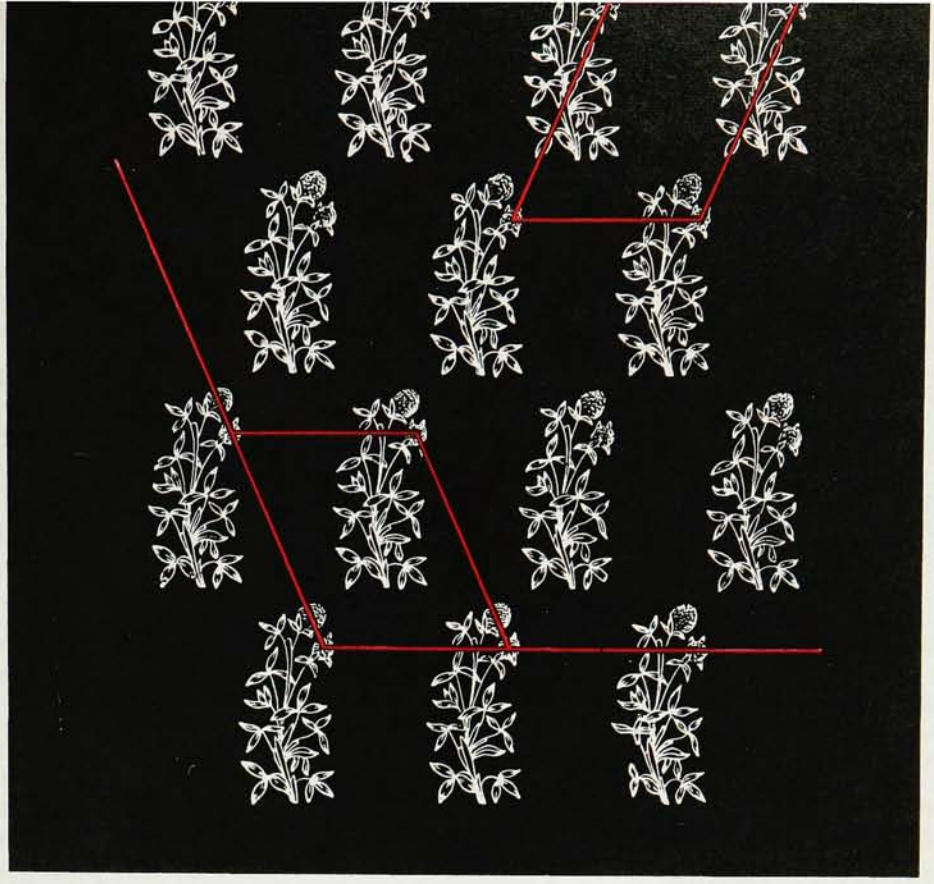
The largest part of the book is devoted to "order," that is, to the crystalline nature of matter. Order is very generally characterized in terms of symmetry, but the author quickly eschews generalities and proceeds to more specific matters such as close-packed versus nonclose-packed arrays of atoms, etc. After a brief treatment of perfect crystalline order, we are introduced to a number of aspects of matter in which the perfect order is disturbed or modified. Liquid crystals and gas crystals are discussed. The concept of "dislocation" is introduced and the various types are lucidly described. The roles of dislocations in the theory of strength of materials and in the theory of crystal growth are discussed. After a treatment of such problems as the nature of alloys and of the problems of order in the realms of magnetic materials and of large organic molecules, the author concludes with a brief general discussion of the "conflict" between order and disorder in nature.

"Disorder" receives a more perfunctory treatment at the author's hands, being little more specifically characterized than by some suggestive but quite undetailed remarks about homogeneity and isotropy. Only in the last section of the book are the notions of probability and disorder connected, and even here too briefly to be very illuminating to the naive reader. Nothing is said of the role of "disorder" in such theories as statistical mechanics, and little is done to clarify for the reader such basic questions as the distinction between laws and initial conditions in determining the ordered or disordered nature of a substance. A statement such as this (page 128):

> "We must conclude that we are confronted with a law of nature in the form of a compromise between two opposing tendencies, that is, between a tendency towards order (achievement of a stable equilibrium), on the one hand, and a tendency toward disorder (achievement of the most probable distribution characteristic of particles in thermal motion), on the other,"

deserves more in the way of theoretical exposition (rather than merely displaying examples) than the author provides. This is especially true as such assertions may easily mislead the lay reader for whom the book is intended. (Just what "law" is the "law of nature" to which the statement refers? Is it *really* a law at all?)

But as a first introduction to that part of the theory of matter that treats crystals, their defects, their modifications and their transitions, the book is highly satisfactory. In particular, the numerous and appropriate diagrams and illustrations are extremely useful in giving the reader new to this branch of science an intuitive grasp of the nature of crystalline arrays and their defects.



WALLPAPER PATTERN illustrates some aspects of crystal lattice structure. (From *Order and Disorder in the World of Atoms.*)

* * *

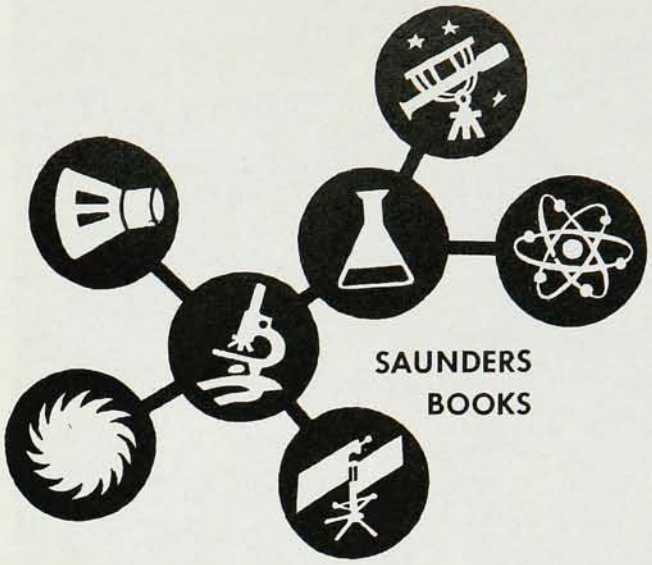
The reviewer is assistant professor of the philosophy of science at Princeton University.

Energy transformation: physics and technology

DIRECT ENERGY CONVERSION. G. W. Sutton, ed. 342 pp. McGraw-Hill, New York, 1966. $14.50

by R. Bruce Lindsay

The transformation of energy from one form to another and its transfer from place to place are at the basis of our modern industrial civilization; economy and flexibility in these processes



DISCOVERY IN PHYSICS

Leonard Greenberg, University of Saskatchewan

This unusual volume serves as a text in experimental physics and a laboratory manual for the introductory course. Discovery is emphasized through 35 experiments which superbly illuminate the nature of physical laws, how such laws are derived, and how their limits and exceptions are discovered.

239 pages, illustrated. $4.75. Published January, 1968.

THEORY OF PHYSICS

Richard Stevenson and R. B. Moore, McGill University

New and uniquely written, this is a textbook of modern physics for the beginning student (with little or no calculus background). In its five sections—Motion, Energy, Oscillations and Waves, Electricity and Magnetism, and Applications—the authors emphasize the structure of the theory and are able to introduce quantum and relativistic ideas. Among it pedagogical aids are 1200 problems, valuable marginal notes, and answers to problems.

795 pages, 577 illustrations. $9.75. Published March, 1967.

SPECIAL RELATIVITY

Albert Shadowitz, Fairleigh Dickinson University

Here is a detailed exposition of special relativity based on the recently developed Loedel Diagram. Through the simplicity of the geometric approach, Dr. Shadowitz makes special relativity comprehensible to the beginner and creates a valuable reference for the high-energy physicist.

203 pages, illustrated. $6.50. Published January, 1968.

THEORETICAL PHYSICS: APPLICATIONS OF VECTORS, MATRICES, TENSORS AND QUATERNIONS

Ali Kyrala, Arizona State University

Emphasizing modern vectorial formulations, Dr. Kyrala presents a concise introduction to the mathematical methods of theoretical physics used today in physical research. Designed for senior/graduate-level courses, the book is equally appropriate for self-study. Numerous illustrative examples elaborate on the text.

359 pages, illustrated. $9.00. Published June, 1967.

INTRODUCTORY NUCLEAR THEORY

L. R. B. Elton, Battersea College of Technology

This is the Second Edition of Dr. Elton's well-known senior/graduate level text and reference. In its investigation of nuclear structure, this concise volume presents the most recent developments of nuclear physics.

332 pages. $6.75. Published June, 1966.

RELATIVITY AND COSMOLOGY

the late H. P. Robertson, Cal. Inst. of Technology
Thomas W. Noonan, University of North Carolina

The fundamentals of special relativity, general relativity, and cosmology are presented in this basic textbook for courses in Relativity and Cosmology at the graduate level. In addition, it is also a primary reference for courses in Cosmology and Modern Physics and of definite professional reference value for those teaching undergraduate physics or astronomy courses.

About 480 pages. Ready August, 1968.

DIFFERENTIAL EQUATIONS

Martinus H. M. Esser, University of Dayton

For their first course in differential equations, this volume for math and engineering majors stresses mathematical understanding rather than superficial learning of techniques. Dr. Esser continually stresses motivation of the theoretical material by providing many imaginative examples.

249 pages, illustrated. $8.00. Published January, 1968.

THEORETICAL ANALYSIS

the late Lester J. Heider, S. J., Marquette Univ., and James E. Simpson, University of Kentucky

This text is designed for a self-contained course in real variables. Incorporating recommendations of the CUPM, the chapters progress through highly developed proofs to those less formal. The text emphasizes definitions, theorems, and proofs as complements to the traditional advanced calculus training in interpretation, techniques, and applications.

379 pages, illustrated. $8.50. Published July, 1967.

PARTIAL DIFFERENTIAL EQUATIONS

I. G. Petrovskii, Moscow State Univ., U. S. S. R.

Translated from the Russian, this is a modern treatment of three basic types of partial differential equations: elliptic, parabolic, and hyperbolic. Special attention is given to recent results in the theory. The book will serve as a basic text for courses at the graduate level or in a topics course at the senior level.

410 pages, illustrated. $9.00. Published April, 1967.

Lectures on REAL AND COMPLEX VECTOR SPACES

Frank S. Cater, Portland State College

Here is an introductory volume on vector spaces and linear algebra. Whereas most books on the subject are matrix-oriented, this volume is operator-oriented in approach. Nevertheless, work on matrices is included. This book is both a senior/graduate-level text and a reference for those studying or working in areas requiring linear algebra.

167 pages. $5.00. Published October, 1966.

SAUNDERS SHORT TABLES

MATHEMATICAL AND PHYSICAL TABLES

Richard Stevenson, McGill University

Printed in handy, pocket-size format, this valuable book for the student contains 30 useful mathematical and physical tables, plus ancillary formulary material. All the tabular material normally required by students of the physical and biological sciences and of engineering is contained.

78 pages. $1.00. Published April, 1967. (Single copy sales from bookstores. From the publisher in multiples of 10 only.)

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are subjects for continual technological research. Such research leans increasingly on basic physical investigations of the properties of solids, liquids and gases. This is convincingly illustrated in the book under review, which discusses various methods for the more direct conversion of energy into the convenient electrical form of such widespread use in modern life.

The standard method of powerplant generation of electrical energy involves the several stages of conversion of the chemical energy of fossil fuels (or the energy of nuclear fuels) into thermal energy, thence into mechanical energy by means of some form of heat engine and finally into electrical energy through the Faraday dynamo effect. The present volume, one in the Inter-University Electronics Series, is devoted to an examination of five methods for the direct conversion of thermal into electrical energy. These are based respectively on the photovoltaic effect, the fuel-cell concept, the thermoelectric effect, magnetohydrodynamics and thermionic emission. Each subject is treated by one or more experts in the field, all but one of whom are research scientists or engineers in various research and development laboratories of the General Electric Company. Sutton, the editor of the volume and a member of the staff of the Avco-Everett Research Laboratory, also contributes the section on magnetohydrodynamic power conversion.

An unusually helpful feature of the volume is the thorough treatment of the physical basis of each conversion process. The section on the photovoltaic cell (prepared by J. F. Elliott), for example, is prefaced by a very clear, if brief, exposition of the nature and behavior of semiconductors. This is followed by a description with clear diagrams and well drawn graphs of the properties of various types of cells and the uses to which they are being put, mainly of course in the space-exploration field, in which solar energy is available as the primary source.

Increasing interest in the fuel cell as a direct energy converter is recognized in a 60-page article written by W. T. Grubb and L. W. Niedrach. Such a cell, like a battery, transforms chemical energy directly into electrical energy, but since the oxidizable material can be very much lighter than that in the conventional electric battery, the fuel cell possesses distinct weight advantages. The fundamental principle of the fuel cell is clearly described, and numerous practical models are discussed, along with appropriate diagrams.

AVCO MARK V MHD GENERATOR produces a dc output of 31.3 megawatts. It is a rocket-driven device with a self-excited magnet, requiring no outside power.

The thermoelectric effect has, of course, been known for a long time, but until relatively recently was not used for energy conversion. The measurement of the thermoelectric properties of certain semiconductors has recently aroused renewal of interest in the practical possibilities of the effect, particularly in the field of small-scale refrigeration. The basic reversible and irreversible thermodynamics of thermoelectricity is very well presented in the article by Steven I. Freedman, and the practical applications are by no means overlooked.

The magnetohydrodynamic power generator provides an ingenious application of the Faraday electromagnetic induction effect, involving no moving solid parts. It can therefore operate at high temperatures, leading to greater overall efficiency. Compactness of size can also be achieved. It is believed that such devices can be built to generate powers of the order of tens of megawatts for short intervals of time. The article contains an excellent discussion of design characteristics.

The thermionic vacuum tube as an amplifier, that is, a device for drawing energy at a greater rate out of a given source, has long been known, but the use of the effect in direct energy conversion from thermal to electrical form is of more recent origin. Its possible advantages in providing electrical power in remote regions, for example under the sea and in outer space, are now beginning to be realized. This section in the book, prepared by E. Blue and J. H. Ingold, surveys both advantages and difficulties, with an excellent review of the fundamental principles.

All who are interested in any aspects of the problem of energy conversion will find this volume of prime importance.

* * *

The author is Hazard Professor of Physics at Brown University. He is currently interested in the general field of the concept of energy and its transformations.

Topics in elementary particle theory

RECENT DEVELOPMENTS IN PARTICLE PHYSICS. (Summer school, Honolulu, August 1965) Michael J. Moravcsik, ed. 263 pp. Gordon and Breach, New York, 1966. $15.00

by Don B. Lichtenberg

Summer schools in theoretical physics are rapidly proliferating. Among others are the well established schools